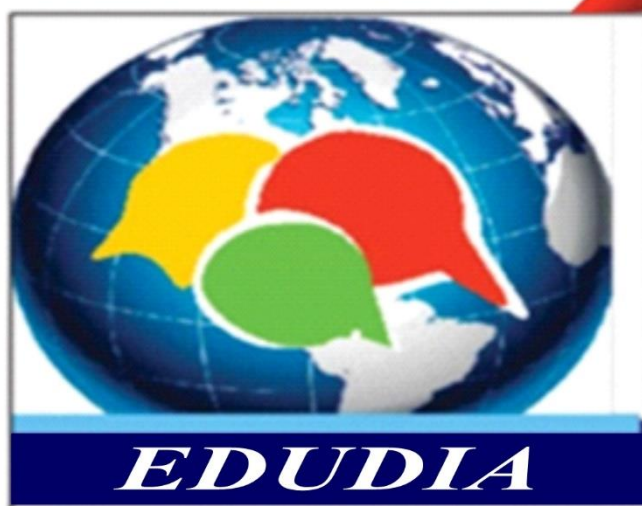


EDUCATION DIALOGUE ASSOCIATION

**JOURNAL OF
MULTIDISCIPLINARY STUDIES**
(EDUDIA-JOMS)



EDUDIA-JOMS VOL. 1 NUMBER 1, 2025

(Maiden Edition)

**PRINT ISSN: 3141-6500
ONLINE ISSN: 3141-6594**

Journal URL: <https://edudia.orgpublications/>

UNIVERSITY OF EDUCATION, WINNEBA, GHANA

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ASSOCIATION JOURNAL OF
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ONLINE ISSN: 3141-6594

University of Education, Winneba, Ghana

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TABLE OF CONTENTS

Journal Policies	ii
EDUDIA-JOMS Editorial Board Members	iii
Note to Contributors	v
Guidelines for Manuscript Submission	vi
 Navigating Ethical Complexities in The Use of AI for Research in Higher Education - Yaro Loveline	 1-14
 Information and Communication Technology Utilization Among Rme Specialism Students in The University of Education, Winneba and its Affiliate Colleges of Education In Ghana: Accessibility, Benefits And Challenges Charles Nyarko Annobil & Ephraim Adanunyo	 15-34
 Relationship Between Principals’ Non-Confrontational Conflict Management Strategy and Teachers’ Compliance with Directive in Secondary Schools in Anambra State Isaac N. Nwankwo	 35-43
 In-Service Training Programme and Academic Staff Productivity in Oyo State Colleges of Education for Sustainable Development Akinpade Oyejoke Adunola & Senimetu Ileuma	 45-56
 Artificial Intelligence (AI) Innovation and Secondary Education in Oyo State: Need for Reassuring Measures for Sustainable Development (SD) Oluwatoyin Isaiah Awolola	 57-68
 Staff Development and Incentives as Predictors of Public Secondary School Teacher’s Productivity in Oyo South Senatorial District, Oyo State, Nigeria - Okemakinde Timothy	 69-78
 Exploring Cultural Heritage as Bastion of African Creativity and Innovations in the Digitalized Era Abiodun Akinola Oladiti, Isaac Oluwatoyin Ogundare, Mulikat Oluwatoyin Mustapha & Amos Olugbenga Ojebisi	 79-87
 Pre-Service Primary School Teachers’ Attitude to The Use of Artificial Intelligence in Learning in Emmanuel Alayande University of Education, Oyo, Oyo State Olumoroti Olaniyi Awolere & Mary Adejoke Jesutoki	 89-95
 From Chalkboard to Chatbots: Revolutionising the Future of Teaching in the University Through Artificial Intelligence Esther Omoniyi Mofoluwawo & Rebecca Adenike Afolabi	 97-107

Integrating Artificial Intelligence in Business Education for Sustainable Development: Empirical Evidence from Public Universities in Southwest Nigeria Solomon Oyelami, Oyewole, Ayinde Dauda, Oladeji, Risikat Mojisola Folorunso, Oladele Nathaniel Olaniyi, & Ibitoye Olayinka	109-118
Artificial Intelligence (Ai) And Sustainability in Nigerian Higher Institutions: Provision for Ethical Considerations Christianah Oluwakemi Alabi	119-130
Perception and Acceptance of Ai-Based Counselling among Undergraduate Students in Oyo State Oyekola Olukayode Oyelade & John Idowu Shittu	131-140
Extent Of Awareness and Utilization of Artificial Intelligence Among Business Education Students in Tertiary Institutions in Ogun State, Nigeria Ileuma Senimetu & Onasoga Olusola Taiwo	141-150
Attitude And Perception of Elderly Persons to Robotic Home Care in Oyo State - Gbenro Abiodun Idowu	151-160
Effectiveness of AI-Driven Career Guidance Systems in Enhancing University Students' Career Development in Southwest Nigeria Olugbenga Oladapo Ayena & Ayotunde Oyedele Oyediran	161-168
Artificial Intelligence, Human Values and Ethical Issues: A Social Responsibility Oyewale, Aderemi Oyetunde	169-176
Leveraging on Artificial Intelligence Tools for Effective Instructional Delivery of Social Studies and Civic Education for Sustainable Development Olukunle Ayanwale	177-183
Enhancing Student Engagement and Sustainable Development in Education: Perception and Experience of Secondary School Students with Artificial Intelligence (AI)-Powered Personalized Learning Odunola Lovelynn Boluwatife Mogbeyiteren & Adedigba Praise Abina	185-198
Psychological Determinants of Learning Effectiveness: The Role of Emotional Intelligence, Self-Reflectiveness and Cognitive Control in Advancing Qualitative Education (Sdg-4) for Sustainable Development in Nigeria - Elinah Yemisi Olanrewaju	199-210
AI For Policy Compliance and Sustainable Early Childhood Education in Nigeria: A Theoretical Perspective Bolaji Gabriel Popoola	211-218

Nurturing Excellence in Early Childhood Education Through Artificial Intelligence for Sustainable Development in Oyo Metropolis Nursery Schools, Oyo State, Nigeria Oladapo Johnson Olayanju	219-234
The Perceived Role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development in Oyo State, Nigeria Amos Ayoola Odeleye	235-246
Relationship Between Tertiary Institutions Students' Expectations of Employment in the World Market and Sustainability Skills After Graduation Johnson Tunde Ajiboye	247-258
Artificial Intelligence (AI) For Sustainable Development: Assessing its Impact on Teaching - Learning Process in Public Tertiary Institutions in Oyo State Rebecca Adenike Afolabi & Esther Omoniyi Mofoluwawo	259- 270
Awareness, Attitude and Utilisation of Artificial Intelligence Tools Among Undergraduates Education Students in Public Universities in Osun State, Nigeria Sunmola Kadiri Adegoke, Olufunmiso Olatunbosun Ajala, Kehinde Olugbenga Aluko, Yemisi Adeola Ayoola, Adekemi Olufunke Akanbi & Ogechi Rita Osuala	271-282
Impact Of Online Learning Environments on The Academic Performance of Students with Learning Disabilities in Lagos State, Nigeria: An Analytical Study Feyisetan Christianah Toyin & Olubanke Adeleye Olaojo	283-292
Leadership, School Administration and The Output of Teachers and Students in Public and Private Secondary Schools in Bayelsa State, Nigeria Grace Barinaada Ibaba	293-304
Artificial Intelligence in Higher Education for Self-Reliance: A Key Imperative for Sustainable Development Phillemon Hananiya & Francis Olajire Awodoyin	305-313
ICT Adoption Practices and Sustainability of Private Secondary Schools in Cross River State, Nigeria Ayang, John Etura; Ibe Odum Ibe; Effiom, Eme Inyang & Mary Bassey Okwa	315-324
Integrating Artificial Intelligence in Educational Management: A Catalyst for Sustainable Development in African Institutions Ajidele Ajoke Oluwafisayo & Ileuma Senimetu	325-331
Teachers' Job Commitment in Public Secondary Schools in Southwest, Nigeria Babatunde Joseph Kolashi	333-242

The Use of Artificial Intelligence in Developing Sophisticated and Flexible Evaluation Tools Ejuchegahi A. Angwaomaodoko	343-353
Artificial Intelligence, Academic Self-Efficacy and Learning Outcomes of Office Technology and Management Students in Southwest, Nigeria Lydia Yemisi Oludele, Eseza Akiror Erwat & Matthew Adebayo Aina	355-361
Integration of Artificial Intelligence into The Teaching of Home Economics Education Practical Skills Oluwaleyimu Olufunke Opeyemi	363-372
Artificial Intelligence in Business Education: A Review Dosunmu, Margaret Moronke	373-381
Vocational Education Funding Accountability and Period Poverty- Interconnecting Unsds 1, 3, 4 And 5 to Achieve Zero Poverty by 2030 Shakirat Adepeju Babatunde, Ngozi E. Uzoka & Cliff Ntimbwa Manongi	383-397
Exploratory Review of The Potentials, Impacts and Ethical Dimensions of Artificial Intelligence in Home Economics Education Abigail Olukemi Olugbamigbe & Feranmi Boluwatife Oluwagbemileke	399-410
Development of Business Education in Nigeria: Trends, Challenges and Prospects Aminu Ahmed Chiroma	411-419
Digital Preservation of University Records Using Emerging Technologies: A Survey of Staff of Establishment Units' Level of Awareness, Readiness and Adoption in Universities in the South-South Region of Nigeria Lovet Ovigwe Esievo & Ebikabowei Emmanuel Baro	421-434
Efficacy of Adaptive Personalized Digital Learning Platform on Integrated Science and Physics Education Students' Understanding of Energy in University of Lagos, Nigeria Veronica Folasade Titilayo Babajide	435-445
Harnessing The Power of Ict Usage in Steam to Improve the Quality of Teaching and Learning in Nigeria Flourish Isaac-Oloniyo	447-453
Investigating The Perceptions and Acceptance of Artificial Intelligence Integration in General Studies Among Medical-Related Students at University of Nigeria Enugu Campus (UNEC) Oguejiofor, Chidumebi Ngozi; Ani Anthonia Nwabugo; Obiekwe Kingsley Kenekwkw; Thompson, Chidinma Chinenye; Ogbo, Rosita Nwaribeaku & Eziamaka, Chika Nnoye	455-470

Effect Of Problem-Solving Technique on Upper Basic School Students’ Academic Achievement in Basic Operations in Egbeda Local Government Area, Oyo State Oluwole Eyitayo Adewale, Tunde Rasheed Raheem & Christianah Olajumoke Sam-Kayode	471-478
Emotional Intelligence, Technological Self-Efficacy as Predictors of Undergraduates Guidance and Counselling Students Utilization of Artificial Intelligence Shittu, John Idowu & Oyelade, Oyekola Olukayode	479-484
Teachers' Readiness and Capacity for Artificial Intelligence Adoption in Nigeria Secondary Schools A Study of Anambra State Okafor Judith Nneka, Ezenwagu Stephen Abuchi, Ogbuanya Patience Chiamaka, Nwogbo Mercy Obianuju, Obineme Patience Obiageli & Chukwu Regina Nwamaka	485-496
Effect of Artificial Intelligence (AI) on the Teaching of Economics in Senior Secondary Schools in Nigeria Sheidu Kamoru Olanrewaju & Ubogu Cynthia Uche	497-507
Code - Mixing and Code - Switching: Style of Language Use Among Igbo Gospel Artists Ugwu, Ifunanya Gertrude, Enu Evelyn Nwene, Babalola, Joseph Oladipupo & Osuala Emmanuel Mmaduabuchukwu	509-520
Harnessing Artificial Intelligence to Bridge Language Gaps: A Pathway to Inclusive and Sustainable Multilingual Education in Africa Christianah Oluremi Tolani Obawaludo & Senimetu Ileuma	521-528
AI And Narratology in Oral Literature Education for Sustainability Ufuoma R. Davies	529-537
Towards Integration of Online Learning for Self-Development among Managers of Small and Medium Scale Enterprises in Awka South Local Government Area, Anambra State Enwezor, Chibuogwu Helen	539-549
Work-Life Balance of Female University Academics in South-Western Nigeria Motunrayo Ajoke Adeosun, Olubunmi Ajoke Aloba & Ronke Christiana Ojo	551-559
Academic Interest as Predictor of Secondary School Students’ Academic Achievement in English Language in Anambra State Nneka Anthonia Obumse	561-569
Artificial Wisdom as Predictor of Senior Secondary School Students’ Academic Achievement in Civic Education in Nnewi Education Zone of Anambra State	

Awadiegwu Amaka Emmanuela; Oranusi Ndidi Stella; Udegbe Charles Chigozie & Ughenu Nwamaka Perpetua; Edor Job John	571-576
Locus Of Control as Predictor of Secondary School Students’ Academic Achievement in English Language in Onitsha Education Zone of Anambra State Uba Mercy Benedette Ifeoma	577-586
Relationship Between Principals’ Non-Confrontational Conflict Management Strategy and Teachers’ Compliance with Directive in Secondary Schools in Anambra State Isaac N. Nwankwo	587-595
Self-Esteem As Predictor of Secondary School Students’ Academic Achievement in Awka Education Zone: Implications for Classroom Management Okeke, Nonyem Ifediorah	597-603
Artificial Intelligence and Teachers' Professional Development: A Panacea for Sustainable Education Practices in Nigeria. Nwodo Chizitelu Emmanuel, Onwumbiko Agatha Nkechi, Okonkwo Lilian Tochukwu, & Ezema Getrude Chinonso	605-613
Influence of Online Learning on Cognitive Development of Basic Education Pupils in Onitsha, Anambra State Emegwa Tina Uzoamaka	615-623
Principals’ Awareness and use of Artificial Intelligence Tools for School Administration in Secondary Schools in Anambra State, Nigeria Ekwuruibe Charity Adaobi & Israel Chijiuka Oparaji	625-631
Artificial Intelligence, Education and Sustainable Development Victor Antwi	633-635
Influence of Teachers’ Motivation and Students’ Academic Performance: A Study of Secondary Schools in Enugu State, Nigeria Rebecca Ebonam Chikendu & John Amaoge Wordu	637-645
AI And the Future of Education in Developing Countries: Issues and Prospects Akeem Amodu, Bamidele Stephen Omoyajowo & Femi Adeoye Alabi	647-658

NAVIGATING ETHICAL COMPLEXITIES IN THE USE OF AI FOR RESEARCH IN HIGHER EDUCATION

Yaro Loveline

Department of Curriculum Studies and Teaching,

Faculty of Education, University of Buea

237 675987737

lyulay2000@gmail.com

Introduction

In the contemporary landscape of the 21st century, higher education stands as a cornerstone for societal progress and intellectual advancement. It is not a mere tool for personal career development but a critical institution that fuels national and global transformation. Higher education serves as a dynamic engine for generating and disseminating knowledge, advancing academic disciplines, and nurturing individual potential while addressing broader societal needs. The influence of higher education extends across multiple dimensions, including economic development, social mobility, knowledge production, and civic responsibility. According to Bates et al. (2020), institutions of higher learning contribute directly to economic growth by equipping students with skills demanded by the labor market, fostering innovation through research, and cultivating an informed citizenry capable of engaging thoughtfully in democratic processes.

On an individual level, higher education empowers learners with the competencies necessary for professional success, such as critical thinking, communication, problem-solving, and technical proficiency. These capabilities are essential not only for career advancement but also for lifelong learning and adaptability in an increasingly complex and globalized world. On a societal level, a well-educated population drives innovation, supports public institutions, and contributes to the democratic fabric by engaging in civic life, voting, and participating in community development.

From a macroeconomic perspective, the presence of a strong higher education system is often correlated with enhanced national competitiveness. The European Parliament (2021) emphasizes that countries investing in education—especially in advanced research and development (R&D)—tend to lead in technology, healthcare, sustainability, and global policy. This investment also attracts multinational enterprises seeking skilled talent and stable research ecosystems, further reinforcing the country's position on the world stage.

Historically, the role of higher education has transcended beyond mere vocational preparation. Philosophers and educational theorists such as Lev Vygotsky (1978) and Jean Piaget (1972) argued that education is intrinsically linked to the development of moral reasoning, wisdom, and spiritual enrichment. In this context, universities are not just centers of knowledge transmission but also guardians of human values such as truth, justice, empathy, and equity. Higher education has traditionally been viewed as a solution to some of society's most persistent challenges, from poverty and inequality to political instability and environmental degradation.

The Role of Research in Higher Education

At the core of higher education lies research, which plays a pivotal role in driving institutional innovation and societal change. Research activities enable academics and scholars to investigate cutting-edge ideas, test new theories, and explore potential solutions to global challenges such as climate change, disease outbreaks, and social injustice. In essence, research contributes to the

continuous refinement of human understanding, allowing society to respond more effectively to emerging threats and opportunities.

Akinwalere and Ivanov (2022) highlight that research serves as a critical link between academia and industry, creating pathways for the practical application of academic knowledge. Collaborative research efforts involving universities and private enterprises can lead to the invention of transformative technologies, the refinement of production processes, and the creation of new markets. This symbiotic relationship ensures that research findings are not confined to academic journals but are translated into tangible innovations that improve daily life, ranging from medical devices and renewable energy solutions to data analytics tools and educational platforms.

Moreover, research significantly contributes to economic development. The process of conducting research creates employment opportunities for academic staff, postdoctoral researchers, lab technicians, and administrative personnel. Furthermore, institutions that excel in research tend to attract substantial funding from government bodies, non-profit organizations, and private investors. This funding not only boosts the local economy but also enhances the global prestige of the institution.

As Zentner (2022) notes, world-class research environments act as magnets for top-tier talent. Highly skilled researchers and academics seek institutions that provide access to advanced facilities, interdisciplinary collaboration, and intellectual freedom. By cultivating such an environment, universities position themselves as leaders in their respective fields and contribute to the broader scientific and technological progress of society.

The Technological Transformation of Academic Research

In recent decades, the nature and methodology of academic research have been profoundly reshaped by technological innovation. The integration of advanced digital tools into the research process has expanded the boundaries of what scholars can investigate and achieve. Technologies such as cloud computing, big data analytics, machine learning, and artificial intelligence have revolutionized the research landscape by allowing academics to collect, process, and interpret data at unprecedented scales and speeds.

Access to large-scale datasets such as those generated by social media, government agencies, satellite imaging, or genomic sequencing has opened up new avenues for exploration that were previously unfeasible. These data-driven research initiatives provide insights into complex patterns, behaviors, and systems, thereby enhancing the precision and scope of academic inquiry.

In addition to enabling new forms of analysis, technology has also fostered global collaboration among researchers. Online communication platforms, digital libraries, and collaborative software tools have reduced the geographical and logistical barriers that once constrained academic partnerships. Today, it is commonplace for a research project to involve scholars from multiple countries working together in real-time, often across disciplines such as engineering, medicine, social science, and the humanities.

As Freeman et al. (2014) suggest, this rise in interdisciplinary collaboration is one of the most impactful developments in modern research. Complex global problems—such as pandemics, climate change, or misinformation—cannot be solved through isolated expertise. Instead, they require the integrated efforts of experts from different domains who can contribute unique perspectives and methodologies. Interdisciplinary research not only enriches the quality of academic output but also aligns research agendas with the multifaceted nature of real-world problems.

Furthermore, the use of digital publication platforms and open-access repositories has democratized access to research findings. Scholars, students, policymakers, and practitioners can now access cutting-edge research without the constraints of institutional subscriptions or physical libraries. This open flow of information accelerates innovation, promotes transparency, and bridges the gap between academic discovery and public application.

The Strategic Importance of Technology in the Knowledge Economy

In today's knowledge-driven economy, the strategic deployment of technology in higher education research is more than a convenience—it is a necessity. Institutions that fail to adopt and integrate emerging technologies risk falling behind in both academic output and societal impact. Conversely, universities that embrace digital transformation gain a competitive edge in publishing, partnerships, student recruitment, and funding opportunities.

The convergence of technology, research, and education creates a synergistic environment in which students and faculty can pursue their academic goals more effectively. For instance, AI-powered research assistants can help analyze literature, summarize findings, and generate research hypotheses. Data visualization tools can turn abstract statistics into digestible insights, aiding both academic publications and public engagement.

In this way, technology serves as a catalyst for a more dynamic and responsive research culture, one that is capable of adapting to shifting societal needs, policy agendas, and scientific discoveries. By leveraging these tools strategically, higher education institutions can ensure they remain at the forefront of innovation and continue to fulfill their mission of advancing human knowledge for the benefit of all.

Context and Problem

In modern educational landscapes, there is a growing commitment to integrating technology-enhanced approaches that improve teaching and learning outcomes in ways that are safe, effective, and scalable. Institutions across the globe are embracing tools that harness the power of artificial intelligence (AI) to support both educators and learners. These AI-powered solutions—ranging from everyday applications like virtual assistants to advanced academic tools for grammar correction, predictive text, and content generation—are becoming increasingly embedded in the professional routines of educators (Al Ka'bi, 2023; Aldosari, 2020).

Educators are not only using AI to simplify daily tasks but are also actively exploring its potential to transform the educational experience. AI technologies promise to provide more personalized, responsive learning environments by tailoring instructional content and research tools to individual student needs. AI-driven systems can help design or modify lesson plans, assist in curating and adapting educational resources, and support student learning through real-time feedback and adaptive assessments (Zentner, 2022). These technologies aim to enhance the efficiency of academic workflows and elevate the quality of education through intelligent automation and data-informed personalization.

However, despite these potential benefits, the deployment of AI in educational settings raises critical ethical and practical concerns. A primary issue is the potential for algorithmic bias, where AI systems, trained on skewed or incomplete datasets, reinforce systemic inequalities. For instance, AI tools might unintentionally disadvantage marginalized student populations through biased recommendations, grading inconsistencies, or misinterpretation of input data. Moreover, the opaque nature of AI decision-making—often referred to as the “black box” problem—limits

transparency and accountability. Educators and learners may not fully understand how or why an AI system arrives at specific conclusions or suggestions (Nsoh et al., 2023; Park & Ahn, 2024).

Data privacy and surveillance are also pressing concerns. AI systems often require large volumes of sensitive personal data to function effectively, raising the risk of data misuse or breaches. Students may be unaware of how their data is collected, stored, or analyzed, which can erode trust in educational institutions and violate regulatory standards. Additionally, the widespread implementation of AI could inadvertently exacerbate educational inequalities, particularly in under-resourced institutions that lack access to high-quality AI infrastructure or training for faculty and staff (Sullivan et al., 2023; Churi et al., 2022).

Another significant issue is the absence of consistent ethical frameworks and policies to guide the responsible use of AI in higher education. Although some institutions have begun developing guidelines, many still operate without comprehensive standards to ensure fair, accountable, and transparent AI use. This regulatory gap limits institutions' ability to protect student rights, uphold academic integrity, and ensure ethical research practices (Serpa et al., 2020; Popenici & Kerr, 2017).

As AI continues to permeate higher education, it is imperative to critically examine its ethical dimensions, especially in research contexts where human participants and data are involved. Responsible AI use must be embedded in institutional strategies through clear governance structures, continuous monitoring, and the active involvement of diverse stakeholders—including educators, researchers, students, policymakers, and technology developers.

To address these emerging challenges and opportunities, this research paper investigates the following core questions:

1. What are the different conceptions of AI and its importance in higher education research?

This question explores the varied definitions and theoretical understandings of AI, emphasizing how these interpretations influence its role in advancing knowledge and academic research (McCarthy, 2007; Kaplan & Haenlein, 2019).

2. What ethical issues arise from using AI in higher education research, and how can institutions balance these benefits with the need to protect proper and inclusive use in practice?

This question focuses on the risks associated with the use of AI—especially concerning sensitive student data—and seeks strategies for ensuring equitable and ethical integration of AI tools (European Parliament, 2021; Park & Ahn, 2024).

3. In what ways can higher education institutions guarantee the ethical development and application of AI in research, safeguarding the rights and welfare of both researchers and participants?

This question addresses the practical challenges involved in implementing ethical AI policies in research settings and explores institutional responsibilities for developing trust and accountability mechanisms (Akinwalere & Ivanov, 2022).

What Is Artificial Intelligence?

Artificial Intelligence (AI) refers to the branch of computer science dedicated to creating machines and systems capable of simulating aspects of human intelligence. These capabilities typically include reasoning, learning from experience, interpreting natural language, recognizing visual and

auditory patterns, making decisions, and solving problems (McCarthy, 2007; European Parliament, 2021). AI systems aim to replicate or augment cognitive functions in ways that can adapt and improve over time through data-driven learning processes.

AI is a broad and evolving field, often described as an umbrella term encompassing a wide range of technologies, including machine learning, natural language processing (NLP), computer vision, robotics, and expert systems. The common thread among these domains is the capacity for machines to exhibit behavior that would traditionally be considered intelligent if performed by humans.

Over the years, several influential figures and organizations have offered definitions that capture different dimensions of AI. Minsky (1968, p. v) defined AI as “the science of making machines do things that would require intelligence if done by men.” Berkeley (1997) referred to it as “the study of man-made computational devices and systems which can be made to act in a manner which we would be inclined to call intelligent.” McCarthy (2007) emphasized both the scientific and engineering aspects, stating that AI is “the science and engineering of making intelligent machines, especially intelligent computer programs.” Kaplan & Haenlein (2019, p. 17) described AI as “a system’s ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation.” The European Parliament (2021) characterized AI as “the ability of a machine to display human-like capabilities such as reasoning, learning, planning, and creativity.” In lay terms, AI can be understood as the “brain” behind smart technologies, enabling computers, robots, and software to perform tasks that once required human intelligence. These tasks range from voice recognition and real-time translation to personalized recommendations and autonomous decision-making.

The scope and utility of AI have grown exponentially, particularly with the advent of machine learning—a subfield of AI that allows systems to improve their performance by analyzing large volumes of data without explicit programming. This has led to significant breakthroughs across sectors such as healthcare (e.g., diagnostic AI tools), finance (e.g., fraud detection algorithms), manufacturing (e.g., predictive maintenance), and education. In higher education, AI technologies are reshaping teaching, learning, research, and administration. Tools powered by AI can automate routine tasks (such as grading or plagiarism detection), provide real-time tutoring or feedback, personalize course content based on student performance, and assist faculty with research data analysis and publication support (Akinwalere & Ivanov, 2022; Nsoh et al., 2023). Additionally, AI’s capacity to analyze vast educational datasets allows institutions to monitor learning outcomes, predict student performance, and design targeted interventions that improve retention and engagement (Al Ka’bi, 2023). As these technologies continue to mature, they offer both opportunities and risks. On one hand, AI can democratize access to education, support diverse learning needs, and optimize institutional operations. On the other hand, unchecked or poorly governed use of AI could reinforce existing disparities, compromise privacy, and erode academic integrity. Thus, understanding the definitions, implications, and ethical considerations of AI is essential for educators, administrators, and policymakers who seek to navigate this transformative landscape responsibly.

The Importance of Artificial Intelligence in Higher Education Research

Artificial Intelligence (AI) is a fast-growing field of technology that centers on developing machines capable of performing tasks that typically require human cognition. These tasks include, but are not limited to, language comprehension, visual recognition, complex problem-solving, pattern detection, and making decisions based on data (McCarthy, 2007; European Parliament,

2021). As AI continues to evolve, its integration into higher education has created transformative possibilities, particularly in the areas of research, teaching, and administrative operations.

In academic research, AI technologies significantly enhance efficiency, productivity, and the ability to manage large volumes of data. AI can automate routine yet time-consuming tasks such as conducting literature reviews, coding data, and running simulations, allowing researchers to focus on higher-order analytical and theoretical work that requires critical thinking and creativity (Akinwalere & Ivanov, 2022; Nsoh et al., 2023). Machine learning algorithms can rapidly analyze complex datasets, detect correlations, and generate predictive models that would be difficult or even impossible to identify manually. This not only accelerates research timelines but also opens new pathways for innovation and interdisciplinary collaboration.

AI also supports teaching and learning by enabling personalized and adaptive learning environments. Intelligent systems can tailor educational content to the specific needs, preferences, and learning progress of individual students (Al Ka'bi, 2023; Zentner, 2022). For example, AI-driven platforms can analyze students' academic records and real-time performance data to identify learning gaps, recommend targeted resources, and modify lesson plans accordingly. These tools provide instructors with data-informed insights, helping them make more effective pedagogical decisions and deliver more inclusive and responsive instruction (Aldosari, 2020).

Furthermore, AI technologies contribute to reducing educational inequalities by creating scalable, accessible, and customized learning experiences. Adaptive learning systems can adjust the pace and complexity of instructional content based on student performance, making education more equitable and engaging, especially for diverse learners (Freeman et al., 2014). AI also aids in student retention and engagement by predicting academic risks early and prompting timely interventions.

In the administrative domain, AI is increasingly used to streamline campus operations and improve the student experience. Through the integration of digital systems and physical infrastructure, universities can offer smarter and safer environments. Applications range from automating admissions processes and academic advising to managing facilities and scheduling, thus increasing overall institutional efficiency (Bates et al., 2020). AI also supports global research collaboration by providing cloud-based tools and platforms for knowledge exchange, virtual experimentation, and multi-institutional project coordination.

Examples of AI Use in Higher Education

AI's applications in teaching, learning, and research are diverse and growing. Examples include:

- Adaptive learning systems that deliver personalized content based on individual progress.
- Automated grading software that reduces instructor workload and ensures consistency in assessment.
- Data analytics and visualization tools that aid in detecting patterns in research datasets.
- Translation technologies that promote multilingual learning and global academic collaboration.
- Learning management systems (LMS) with recommendation features to match learners with helpful resources.
- Intelligent tutoring systems that provide personalized academic support.
- Plagiarism detection tools that uphold academic honesty and standards.
- Predictive analytics to forecast student outcomes and recommend timely interventions.
- Course and resource recommendation engines that support student success.

- Speech recognition software for transcribing lectures and improving accessibility.
- AI-driven student support services, such as mental health chatbots and academic advisors.
- Text mining tools for processing and analyzing large volumes of scholarly literature.
- Virtual assistants for responding to student inquiries and administrative tasks.
- Immersive virtual reality for experiential and simulation-based learning (Zentner, 2022, pp. 1–2).

Guiding Principles for AI Integration

Aldosari (2020) proposes ten foundational principles for the ethical and pedagogically sound implementation of AI in education. These include the automation of routine tasks, such as grading and feedback; personalized instruction; enhanced access to knowledge; identification of learning gaps; support for exploratory learning; and transformation of educators' roles. AI, in this view, is not a replacement for teachers but a tool that can amplify their effectiveness and redefine how educational content is delivered and assessed.

Ethical and Implementation Challenges

Despite its benefits, the deployment of AI in higher education raises several ethical, practical, and policy-related concerns. Key issues include:

Equity and access: Not all students or institutions have equal access to the technological infrastructure required for AI-enhanced learning.

Bias and fairness: Algorithms may unintentionally reinforce existing social or cultural biases, especially when trained on unrepresentative data.

Data privacy and security: The collection and processing of sensitive student information raise significant concerns about consent, confidentiality, and data ownership.

Transparency and accountability: Many AI systems operate as "black boxes," making it difficult to understand how decisions are made.

To address these challenges, educational institutions must adopt robust ethical frameworks, conduct ongoing impact assessments, and develop clear guidelines for data governance and algorithmic accountability (Nsoh et al., 2023; Churi et al., 2022; Popenici & Kerr, 2017; Serpa et al., 2020). It is equally important to provide comprehensive training for educators and researchers to ensure they are equipped to use AI tools responsibly and effectively.

Finally, successful AI implementation depends on overcoming institutional barriers such as limited funding, fragmented policy support, and a lack of coordinated strategic vision. Promoting interdisciplinary collaboration, inclusive design, and regulatory oversight will be essential for ensuring that AI contributes positively to the future of research and learning in higher education (Salvagno, Taccone, & Gerli, 2023).

Risks Associated with Excessive Dependence on AI in Higher Education Research

While the adoption of artificial intelligence (AI) in higher education offers numerous advantages—such as improved access to learning materials, personalized instruction, and streamlined administrative tasks—it also introduces a series of complex challenges and potential drawbacks. Excessive reliance on AI systems in academic contexts can compromise core educational values, diminish critical learning processes, and create ethical and practical concerns

that must be addressed to maintain the quality and integrity of higher education (Sullivan et al., 2023; Park & Ahn, 2024).

1. *Threats to Academic Integrity*

A primary concern is the potential for AI to facilitate academic misconduct. Tools capable of generating high-quality essays, problem sets, or presentations may tempt students to submit work they did not produce themselves. These AI-generated outputs often closely resemble genuine student submissions, making it difficult for instructors to detect dishonesty (Sullivan, Kelly, & McLaughlan, 2023).

Such misuse can result to a disconnection between submitted work and a student's actual knowledge or abilities. For example, students might submit AI-created essays but fail to articulate or defend their ideas during oral assessments or peer discussions. This undermines the credibility of assessments, as superficial outputs are rewarded without verifying true understanding (Rasul et al., 2024). In the long run, this trend can erode the value of academic qualifications and diminish the overall purpose of education. Institutions must therefore develop robust strategies to uphold academic integrity, encourage original thinking, and design assessments that prioritize meaningful engagement (Freeman et al., 2014; Churi et al., 2022).

2. *Impaired Learning and Skill Development*

AI can disrupt essential cognitive processes involved in learning—especially when used to complete complex tasks such as writing, data analysis, or argument construction. Writing, for instance, helps students organize their thoughts, synthesize multiple sources, and engage in critical self-reflection (Sullivan et al., 2023). These activities build key academic skills like:

- Logical reasoning through structured argumentation,
- Analytical thinking via source comparison and synthesis, and
- Metacognition through reflection on one's learning and thought processes.

When AI replaces student effort in these areas, learning becomes shallow. Overdependence on AI may deprive learners of the mental struggle that fosters deeper understanding, critical thinking, and long-term retention. Therefore, educators must carefully design tasks that preserve intellectual rigor and ensure that AI serves as a supportive tool rather than a replacement for deep learning (Rasul et al., 2024; Freeman et al., 2014).

3. *Uncertainty about the accuracy and credibility of AI outputs*

AI systems often generate information that appears correct but may contain errors, biased perspectives, or oversimplifications. This happens because AI models operate based on statistical correlations rather than true comprehension or reasoning (BBC News, 2023; Park & Ahn, 2024). Consequently, AI tools may:

- Present misleading or outdated information,
- Omit important context or nuance,
- Provide ethically questionable responses.

Such issues are problematic when students rely on AI-generated content without critical evaluation. This can weaken their ability to distinguish credible sources, assess the validity of arguments, and formulate independent judgments—skills that are essential for academic research and discourse (Popenici & Kerr, 2017; Serpa et al., 2020).

4. Equity, Accessibility, and the Digital divide

The benefits of AI are not evenly distributed across all student populations. Significant disparities exist due to variations in technological access, digital literacy, and socioeconomic background (Nsoh et al., 2023). Common inequities include:

Access to devices and internet: Students from underprivileged backgrounds may lack reliable hardware or connectivity (Al Ka'bi, 2023).

Limited digital literacy: Some learners are unfamiliar with AI tools and lack training in their effective and ethical use.

Unfair academic advantages: Students with better resources may perform disproportionately better, exacerbating existing educational inequalities (Akinwalere & Ivanov, 2022).

To address these concerns, institutions must invest in equitable technology access, develop inclusive AI policies, and support digital literacy programs that empower all learners equally (Churi et al., 2022).

5. Privacy, surveillance, and data protection risks

AI in education typically requires access to large volumes of personal and academic data to personalize learning experiences and automate tasks (Park & Ahn, 2024). However, this dependency on data creates several risks:

Data breaches: Unauthorized access to student information (e.g., exam results or personal identifiers) could lead to significant harm.

Misuse of data: Improper handling or sharing of data raises ethical concerns about consent and transparency.

Opaque systems: AI algorithms often function as "black boxes," leaving users unaware of how decisions are made or data is processed.

Algorithmic bias: Inaccurate or skewed training data can lead to unfair or discriminatory outputs.

Surveillance culture: Excessive monitoring of student behavior can diminish trust, autonomy, and a sense of academic freedom (European Parliament, 2021; Nsoh et al., 2023).

To safeguard students, universities must adopt stringent data governance frameworks, ensure algorithmic transparency, and maintain ethical standards for AI use (Al Ka'bi, 2023).

6. Decline in critical thinking and active engagement

AI tools may lead to passive learning behaviors if students use them to obtain answers rather than engage with the material. This passive consumption limits opportunities to develop critical skills such as:

- Problem-solving
- Analytical reasoning
- Creative and reflective thinking (Rasul et al., 2024)

This contradicts constructivist learning theories, which emphasize that learning is constructed through social interaction, questioning, exploration, and hands-on experiences (Vygotsky, 1978;

Piaget, 1972). To ensure students remain engaged, educators must balance AI integration with instructional approaches that promote inquiry, dialogue, and collaborative problem-solving (Sánchez-Ruiz et al., 2023).

7. Inadequate assessment of learning and misrepresentation of student abilities

AI use complicates the assessment of genuine student performance. When students submit AI-generated work, traditional assessments like essays and take-home tests may no longer reflect actual knowledge or effort (Sullivan et al., 2023; Rasul et al., 2024). This can result in:

- Inflated grades, giving a false impression of competence,
- Disrupted learning metrics, affecting academic planning and support,
- Unfair comparisons, disadvantaging students who complete work independently.
- To address these issues, educators can employ alternative assessments such as:
- Oral exams that test verbal articulation and comprehension,
- Project-based tasks that simulate real-world applications,
- Collaborative assessments that measure teamwork and individual input,
- Frequent, low-stakes quizzes that provide ongoing feedback (Freeman et al., 2014).

These strategies emphasize the development of human-centered skills like empathy, creativity, and critical analysis—areas where AI cannot fully substitute human learning.

8. Psychological and technological limitations of AI detection

Detecting AI-generated content is an evolving challenge. Current detection tools are not entirely reliable and may generate false positives, wrongly accusing students of misconduct. Such errors can lead to:

- Emotional distress
- Damage to student reputations
- Legal and academic complications (Park & Ahn, 2024)

As AI tools improve, detection mechanisms must keep pace. However, striking a balance between enforcement and fairness is essential to preserve trust and well-being in educational environments (Sullivan et al., 2023).

Recommendations and mitigation strategies

Strengthen Traditional and Creative Assessment Methods: Supervised exams and handwritten assignments can ensure authenticity (Akinwalere & Ivanov, 2022). Creativity-based assessments—such as podcasts, lab reports, or live presentations—discourage AI misuse by emphasizing originality (Sánchez-Ruiz et al., 2023).

Integrate Game-Based and Experiential Learning: Serious games and simulations foster engagement and problem-solving in ways that AI cannot easily replicate (Sánchez-Ruiz et al., 2023).

Adopt Flipped Classroom Models: Students engage with content independently outside class and use in-person sessions for collaborative, active learning—limiting passive AI usage (Freeman et al., 2014).

Teach Responsible AI Use: AI should be introduced as a tool for support, not replacement. Students must be trained to critically assess AI-generated content, understand its limitations, and apply ethical considerations (Al Ka'bi, 2023; Park & Ahn, 2024).

Promote a Culture of Inquiry and Curiosity: Institutions should foster learning environments that reward questioning, exploration, and innovation—cultivating skills that AI cannot replicate (Sánchez-Ruiz et al., 2023).

Conclusion

While AI offers remarkable opportunities for enhancing higher education, unchecked or excessive reliance on these tools presents serious educational, ethical, and equity-related risks. Institutions must develop balanced approaches that protect academic integrity, foster critical thinking, ensure fair access, and support meaningful learning. AI should not replace human learning processes but rather serve as an aid that enhances educational experiences while maintaining their integrity and depth.

According to Rose Luckin, "The learners are in charge; the AI is there to work with the educators to support students to be the best learners they can be. Human educators are a much sought-after resource in this vision, because everybody will need to learn throughout their lives." This quote underscores the crucial role of educators in an AI-integrated educational landscape—one in which technology supports, but does not replace, human-centered learning. As artificial intelligence continues to evolve, its integration into higher education requires ethically guided implementation to fully realize its transformative potential while protecting academic integrity, fairness, and equity. AI offers significant benefits to both students and faculty—ranging from personalized learning experiences and adaptive tools to enhanced research capabilities and administrative efficiency (Al Ka'bi, 2023; Nsoh et al., 2023). When deployed responsibly, AI can accelerate research, support diverse learners, and enhance pedagogical practices, positioning higher education as more inclusive and innovation-driven.

However, these advances also introduce substantial risks. Issues such as algorithmic bias, lack of transparency, data privacy breaches, and the potential for structural inequities must be addressed through robust governance frameworks (European Parliament, 2021; Park & Ahn, 2024). Poorly designed or misapplied AI systems may perpetuate discrimination, erode trust, and distort knowledge creation (Sullivan et al., 2023). Thus, institutions must actively pursue ethical oversight, interdisciplinary collaboration, and continual evaluation of AI practices to mitigate these risks (Churi et al., 2022; Akinwalere & Ivanov, 2022).

Researchers, policymakers, and academic leaders share the responsibility of ensuring that AI is used as a tool for empowerment rather than exclusion. This requires a forward-thinking approach that emphasizes transparency, ethical design, digital literacy, and inclusivity (Serpa et al., 2020; Popenici & Kerr, 2017). Ultimately, the successful and responsible integration of AI in higher education will rely on a collective commitment to foundational academic values—particularly equity, integrity, and the development of lifelong critical and creative learners. Only through sustained ethical stewardship can AI be harnessed to elevate educational outcomes while safeguarding the human-centered mission of academia.

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Appendix 1

Legal and Regulatory Frameworks

As AI becomes more integrated into education, robust legal and regulatory frameworks are essential to protect student data privacy and ensure ethical use.

Global Frameworks

United States:

- *Family Educational Rights and Privacy Act (FERPA)*: Grants rights to parents and eligible students over educational records.
- *Children's Online Privacy Protection Act (COPPA)*: Regulates online services directed at children under 13, controlling personal data collection.
- *Children's Internet Protection Act (CIPA)*: Ensures online safety in schools and libraries (European Parliament, 2021).

European Union:

- *General Data Protection Regulation (GDPR)*: Establishes strict requirements for data protection and privacy, applying to universities collecting data in the public interest.

These frameworks emphasize consent, data minimization, transparency, and accountability—principles equally vital for AI-integrated systems in education (European Parliament, 2021).

African Context

While Africa does not have a continent-wide equivalent of the GDPR, many nations have developed data protection laws aligned with international standards.

Key Principles:

- *Consent*: Explicit permission before collecting or sharing student data.
- *Purpose Limitation*: Data used only for specific, declared purposes.
- *Data Minimization*: Collection limited to essential information.
- *Security*: Measures to prevent unauthorized access or breaches.
- *Transparency*: Clear communication about data use (Nsoh et al., 2023).

Regional Framework:

- *African Union Convention on Cyber Security and Personal Data Protection (Malabo Convention)*: Sets general data protection principles, though ratification is uneven.

Country-Level Examples

- **South Africa**: *Protection of Personal Information Act (POPIA)*—requires consent, secure handling, and transparency.
- **Nigeria**: *Nigeria Data Protection Act 2023*—mandates lawful, fair, and secure data processing.
- **Kenya**: *Data Protection Act 2019*—ensures consent-based, secure, and limited data collection.
- **Ghana**: *Data Protection Act 2012*—applies to both public and private institutions, outlining data processing requirements.

These national laws typically apply to universities, including their use of AI for admissions, grading, and learning analytics (Al Ka'bi, 2023).

University Policies and International Standards

Individual universities often supplement national laws with their own data protection policies, including:

- *Privacy Policies*: Clarifying data collection and use.
- *Data Security Measures*: Technical and organizational safeguards.
- *Transparency Initiatives*: Open communication about rights and practices.

Some universities also align with international standards like GDPR when handling data of EU citizens, or pursue certifications such as ISO/IEC 27001 for information security management (European Parliament, 2021; Nsoh et al., 2023).

INFORMATION AND COMMUNICATION TECHNOLOGY UTILIZATION AMONG RME SPECIALISM STUDENTS IN THE UNIVERSITY OF EDUCATION, WINNEBA AND ITS AFFILIATE COLLEGES OF EDUCATION IN GHANA: ACCESSIBILITY, BENEFITS AND CHALLENGES

¹Charles Nyarko Annobil & ²Ephraim Adanunyo

^{1&2}Department of Basic Education,
School of Education and Life-Long Learning,
University of Education, Winneba, Ghana
cnannobil@uew.edu.gh

Abstract

The study examined the extent to which Information and Communication Technology (ICT) devices are being utilized for educational purposes by learners of Religious and Moral Education (RME) in the University of Education, Winneba (UEW) and its affiliate Colleges of Education in Ghana. Underpinned by a triangulation of the Technology Acceptance Model (TAM), the Technological Pedagogical Content Knowledge (TPACK) framework, and Constructivist Learning Theory, the study adopted both quantitative and qualitative data collection methods were employed. A sample size of 259 students were selected through the purposive and simple random sampling techniques from a population of 350 RME students. Means and standard deviations were used to analyse research questions while an independent sample t-test and correlation analysis were performed to test the two research hypotheses. An independent samples t-test results yielded a t-value of 2.020 with 257 degrees of freedom, and significant p-value of 0.044 showed that male student teachers reported higher levels of challenges in integrating ICT into their studies compared to their female counterparts. Also, the correlation analysis revealed a correlation coefficient (R) of -0.095, indicating a very weak negative relationship indicating that the challenges faced by the students did not significantly impact ICT usage for their educational activities. The findings revealed that the availability of ICT resources among RME specialism student teachers is generally high, particularly for mobile devices and widely adopted platforms like Zoom, Google Classroom, and Microsoft Teams. The RME specialism student teachers at UEW and its affiliated Colleges of Education generally show moderate proficiency in using ICT resources. The study concluded that while ICT resources are generally available to RME specialism student teachers at the University of Education, Winneba (UEW) and its affiliate Colleges of Education, there are gaps in access to certain tools like WeChat and video conferencing software that need to be addressed to ensure equitable access. Among other things, it was recommended to lecturers and management of the University to undertake regular monitoring and evaluation of ICT integration initiatives in order to assess progress, identify emerging challenges, and adjust strategies accordingly.

Keywords: Information and Communication Technology (ICT), Devices, Utilization, Religious and Moral Education (RME), Zoom, Google Classroom, and Microsoft, University of Education, Winneba (UEW)

Introduction

Information and Communication Technology (ICT) is globally recognized to play a pivotal role in contemporary teacher education, by equipping future educators with the digital skills necessary for effective teaching and learning. The issue about ICT usage is also a matter of great concern to students offering Religious and Moral Education (RME) in the University of Education, Winneba

(UEW) and its affiliate Colleges of Education in Ghana. As highlighted by the UNESCO (2019), ICT does not only seek to enrich pedagogical approaches but also supports innovative teaching strategies, enhances learner engagement, and promotes lifelong learning. In teacher training institutions, the integration of ICT broadens access to educational resources, improves communication, and fosters collaboration between trainees and their facilitators. The incorporation of ICT in teacher education enhances teaching quality by enabling pre-service teachers to design digital instructional resources, carry out online research, and replicate real-life classroom scenarios using multimedia tools (Buabeng-Andoh, 2012). Consequently, ICT is essential in preparing teacher trainees including those specializing in Religious and Moral Education (RME) for the demands of 21st-century classrooms. Although, ICT is extensively applied in teaching different subjects, its use in the humanities, particularly in Moral Education and RME, is still limited in many educational settings. RME focuses on fostering ethical values, cultural appreciation, and religious tolerance. ICT tools such as educational videos, interactive presentations, podcasts, and online discussion platforms can help make these abstract themes more tangible and engaging (Ofori-Amanfo & Asiedu, 2020).

One effective example is digital storytelling, which can be employed to portray religious narratives or moral dilemmas, encouraging learners to critically examine their values. Additionally, online platforms can support interfaith and cross-cultural discussions key components of RME. However, studies suggest that many RME students and teachers are not making full use of ICT, largely due to insufficient training or the misconception that technology does not align with moral and religious instruction (Ameyaw & Antwi, 2017). Research indicates that while many teacher trainees have basic ICT proficiency, they often lack the pedagogical expertise to integrate these tools effectively in their instruction (Tella et al., 2007; Agyei & Voogt, 2011). This shortfall is particularly evident among trainees in non-technical disciplines like RME, where the practical application of ICT in lesson planning and delivery is frequently neglected. Factors such as institutional support, access to ICT resources, and the design of the curriculum significantly shape the extent to which trainees utilize technology (Kwapong, 2009). Agyei and Voogt (2011) opine that without continuous professional development and experiential learning opportunities, teacher trainees are likely to fall back on conventional, teacher-centered methods that fail to harness the potential of ICT. Bature and Igwe (2019) reinforce this point, advocating for subject-specific ICT training that aligns with the unique pedagogical aims of disciplines like religious and moral education.

Despite the acknowledged advantages of ICT, its integration into teacher education still encounters numerous challenges such as insufficient infrastructure, unreliable internet access, high costs of digital tools, weak institutional ICT policies, and resistance to change (Pelgrum, 2001). In Ghana, for instance, Osei and Oppong (2020) reported that many Colleges of Education are still equipped with outdated computer labs and do not sufficiently integrate ICT into their teacher training programs. Furthermore, some RME specialism students may feel anxious or lack self-confidence when it comes to using digital tools especially those, they consider complex or unfamiliar. This psychological barrier, combined with the perception that moral and religious subjects require direct human interaction rather than technological mediation, further restricts the adoption of ICT in the teaching and learning of RME. We were therefore motivated by the need to explore the extent to which student teachers offering Religious and Moral Education (RME) in UEW and its affiliate Colleges of Education were utilizing Information and Communication Technology (ICT) as well as the benefits and challenges associated with the ICT usage by the students.

Statement of the Problem

Despite the acknowledged advantages of using ICT, its integration into teacher education still encounters numerous challenges. In practice, however, most Colleges of Education Religious Moral Education (RME) classrooms continue to focus on the normal routine, and exams-driven procedures, with little attention to tasks that require good usage of ICT resources. Efforts have been made over the years to encourage the use of these resources in studying RME (Tella et al., 2007). However, despite these efforts, the challenge persists in some of the colleges. These include insufficient infrastructure, unreliable internet access, high costs of digital tools, weak institutional ICT policies, and resistance to change (Pelgrum, 2001). In Ghana for instance, Osei and Oppong (2020) reported that many Colleges of Education are still equipped with outdated computer laboratories and do not sufficiently integrate ICT into their teacher training programs. Research indicates that while many teacher trainees have basic ICT proficiency, they often lack the pedagogical expertise to integrate these tools effectively in their instruction (Tella et al., 2007; Agyei & Voogt, 2011). This shortfall is particularly evident among trainees in non-technical disciplines like RME, where the practical application of ICT in lesson planning and delivery is frequently neglected. Factors such as institutional support, access to ICT resources, and the design of the curriculum significantly shape the extent to which trainees utilize technology (Kwapong, 2009). This study sought to fill this gap by exploring the extent to which student teachers offering Religious and Moral Education (RME) in UEW and its affiliate Colleges of Education were integrating Information and Communication Technology (ITC) to promote their learning.

Purpose of the Study

The purpose of the study was to explore the extent to which student teachers offering Religious and Moral Education (RME) programmes in University of Education, Winneba (UEW) and its affiliate Colleges of Education were utilizing Information and Communication Technology (ICT) to support their academic work and the perceived benefits and challenges.

Objectives of the Study

Specifically, the study sought to:

1. explore the kinds of ICT resources available to RME specialism student teachers in UEW and its affiliate Colleges of Education in Ghana;
2. investigate the extent of ICT usage (utilization) by RME specialism student teachers in UEW and its affiliate Colleges of Education in Ghana;
3. catalogue the benefits derived by RME specialism student teachers in UEW and its affiliate Colleges of Education in utilizing ICT in their studies; and
4. examine the challenges facing RME specialism student teachers in UEW and its affiliate Colleges of Education in Ghana in integrating ICT into their study.

Research Questions

1. What kinds of ICT resources are available to student teachers offering Religious and Moral Education (RME) specialism in UEW and its affiliate Colleges of Education in Ghana?
2. To what extent are RME specialism student teachers in UEW and its affiliate Colleges of Education in Ghana utilizing ICT resources in support of their study?
3. How are RME specialism student teachers in UEW and its affiliate Colleges of Education in Ghana benefiting from integrating ICT in their study?
4. What are the challenges facing RME specialism student teachers in UEW and its affiliate Colleges of Education in integrating ICT into their study?

Hypotheses

H0¹: There is no significant difference in the challenges confronting male and female RME specialism students in integrating ICT into their studies at the University of Education, Winneba (UEW) and its affiliate Colleges of Education.

H0²: There is no statistically significant relationship (difference) between non-availability of ICT resources and academic achievements of student teachers offering RME in UEW and its affiliate Colleges of Education in Ghana.

Significance of the Study

The findings of the study will sensitize management of the University of Education, Winneba and its affiliated Colleges of Education in Ghana on the need to support the teaching and learning of RME with relevant ICT resources. It is expected that from the findings of the study student teachers would demonstrate moderate proficiency in using ICT, indicating room for improvement in practical ICT skills. Although ICT integration is perceived as beneficial and has its own challenges such as lack of confidence, inadequate training, and unreliable internet connectivity persist. It is also expected that the outcome will constitute a potential source of knowledge, theory and also lead to policy direction for the practice of religious education in the UEW and its affiliated Colleges of Education.

Theoretical Framework

The study is underpinned by three key theories: the Technology Acceptance Model (TAM), the Technological Pedagogical Content Knowledge (TPACK) framework, and Constructivist Learning Theory. The TAM, introduced by Davis, has been extensively applied in contemporary educational research to explore how users adopt technology, with particular attention to perceived usefulness and perceived ease of use (Adu, Akinola, & Fadeyi, 2022). This model is particularly relevant for assessing the extent to which Religious and Moral Education (RME) student teachers at the University of Education, Winneba (UEW), and its affiliate Colleges of Education adopt ICT tools. It directly informs an understanding of their usage behaviours (Research Question 2) and the advantages they associate with ICT use (Research Question 3).

The TPACK framework, developed by Mishra and Koehler, offers a comprehensive perspective for evaluating how student teachers merge technological, pedagogical, and content knowledge in their instructional practices. Contemporary studies highlight its applicability in teacher preparation programs, as it sheds light on how pre-service teachers effectively integrate these domains in real classroom contexts (Chai, Jong & Yan, 2023). Additionally, Constructivist Learning Theory—grounded in the work of theorists like Vygotsky and Bruner—emphasizes the importance of active, experiential, and collaborative learning, which ICT tools can effectively support through platforms like simulations and interactive media (Agyei & Voogt, 2014; Abreh & Mankoe, 2022). This framework supports the research questions by explaining how ICT fosters meaningful learning experiences and what implications arise when such technologies are lacking in RME instruction.

Literature Review

ICT Usage, Benefits, and Challenges

The review of literature revolved around the kinds of ICT resources available to student teachers, the extent of usage of ICT resources in learning as well as the intended benefits and challenges. Agyei and Voogt (2011) contend that without continuous professional development and

experiential learning opportunities, teacher trainees are likely to fall back on conventional, teacher-centred methods that fail to harness the potential of ICT. Bature and Igwe (2019) reinforce this point, advocating for subject-specific ICT training that aligns with the unique pedagogical aims of disciplines like religious and moral education. Despite the acknowledged advantages of ICT, its integration into teacher education still encounters numerous challenges. These include insufficient infrastructure, unreliable internet access, high costs of digital tools, weak institutional ICT policies, and resistance to change (Pelgrum, 2001). In Ghana, for instance, Osei and Oppong (2020) reported that many Colleges of Education are still equipped with outdated computer labs and do not sufficiently integrate ICT into their teacher training programs.

Furthermore, some RME specialism students may feel anxious or lack self-confidence when it comes to using digital tools especially those, they consider complex or unfamiliar. This psychological barrier, combined with the perception that moral and religious subjects require direct human interaction rather than technological mediation, further restricts the adoption of ICT in the teaching and learning of RME.

The presence of ICT resources is a crucial factor in the successful integration of technology into teacher education. In Ghana, multiple studies have pointed to unequal access to essential digital tools across Colleges of Education (Agyei & Voogt, 2014; Ameyaw & Antwi, 2017). Although national initiatives have been launched to improve digital infrastructure in teacher training institutions, many colleges still struggle to obtain adequate ICT tools such as computers, projectors, reliable internet connectivity, and educational software (Boateng et al., 2020). This situation is particularly evident in the field of Religious and Moral Education (RME), where the availability of digital resources that support ethical and moral instruction is scarce. Some progress has been made, as a few colleges have begun implementing e-libraries and digital repositories to fill these gaps (Danso & Amoako, 2021). Providing these resources is essential to ensure that RME student teachers have access to quality instructional materials necessary for effective teaching.

However, the mere availability of ICT tools does not guarantee effective usage; it is equally dependent on the digital literacy of student teachers and the institutional support they receive. Studies indicate that although many trainees possess smartphones and laptops, these devices are often not maximally used for academic work (Buabeng-Andoh, 2012; Ameyaw & Antwi, 2017). Within UEW and its affiliate institutions, RME student teachers reportedly engage with ICT mainly for preparing PowerPoint presentations, searching online for religious content, and collaborating through digital platforms (Owusu-Mensah et al., 2023). Yet, their application of ICT in areas such as lesson planning, classroom delivery, and self-reflection remains limited. According to Abreh and Mankoe (2022), this underutilization is partly due to inconsistent ICT training across Colleges of Education. As a result, the use of ICT is often self-initiated and not deeply embedded within the broader teacher education framework.

The positive impact of ICT integration in teacher education is widely recognized, especially in a global shift towards digital learning. For RME student teachers, ICT offers access to diverse instructional materials including sacred texts, value-based case studies, and interactive media, which can foster greater engagement and deeper understanding of moral concepts (Adu et al., 2022). The use of technology also encourages student-centred teaching approaches, enhances learner interaction, and builds critical thinking and ethical reasoning skills (Okyerere & Opoku-Asare, 2021). Moreover, it allows student teachers to incorporate modern tools like digital storytelling, video clips, and simulations to teach abstract or sensitive moral values more

effectively (Chai et al., 2013). With the introduction of Ghana's competency-based curriculum, the ability to integrate ICT is no longer optional but an essential skill for future educators.

Nevertheless, several obstacles continue to impede effective ICT usage in teacher preparation. Major challenges include insufficient training, lack of clear institutional policies, frequent power outages, and unreliable internet access (Mensah & Frempong, 2020). For RME, additional challenges involve the difficulty in locating digital materials that are culturally and religiously appropriate for diverse classrooms (Amoako & Yeboah, 2024). Many student teachers feel ill-equipped to use ICT tools due to limited practical opportunities during their training (Antwi-Boasiako et al., 2023). Additionally, large class sizes and inadequate technical support services worsen the situation. Overcoming these issues requires strong policy backing, targeted investment, and professional development programs tailored to the specific pedagogical needs of RME instruction.

The continued lack of ICT resources significantly affects the preparedness of student teachers, especially those specializing in RME a discipline that has historically depended on oral and printed resources. The unavailability of well-equipped computer labs, online instructional platforms, and structured digital content reduces opportunities for technological engagement and widens the digital divide (Agyei & Voogt, 2014; UNESCO, 2019). In many instances, student teachers are forced to rely solely on personal devices, often without adequate institutional support or guidance, which leads to inconsistent development of digital competencies (Tamakloe & Amedzro, 2025). Without strategic investment in ICT infrastructure and subject-specific content for RME, student teachers risk entering the profession unprepared for the realities of modern classrooms. Therefore, the lack of ICT resources should be seen not only as a technological concern but also as a pressing pedagogical issue that affects teaching quality and educational equity.

Methodology

The study adopted the pragmatist research paradigm but was hinged on the sequential explanatory mixed method design, in which quantitative data were backed by qualitative data (that is, data from questionnaires and interviews) (Teddlie & Tashakkori, 2003; Creswell & Plano-Clark, 2011). This design helped us in soliciting the views and opinions of the students concerning the subject matter of the study by gathering numerical data while at the same time seeking to have an in-depth understanding of their subjective experiences on the same issues (Cresswell & Plano-Clark, 2011).

Population and Sample

A sample size of 259 RME specialism students were selected through the purposive and simple random sampling techniques from a total population of 350 final year students from UEW and its affiliated Colleges. The total sample size formed 74% of the total population of the RME students (Krejcie and Morgan, 2006). The use of the purposive sampling technique enabled us to select participants who could provide the required information for the study based on their unique characteristics and experiences; while the simple random sampling techniques helped in obtaining a sample that was representative of the larger population with minimal biases.

Unit of Analysis: The student teachers from UEW and its affiliate Colleges of Education across Ghana constituted the main unit of analysis because the study was intended to explore the extent to which they were incorporating ICT into their study of RME.

Instrumentation

Data were derived through questionnaires and interview instruments after they had been subjected to pretesting for the purposes of validation and reliability. The questionnaire consisted of 58 close-ended items, which were structured on a Four-Point Likert-Type scale of 'Strongly Disagree (SD)' to 'Strongly Agree (SA)' and also 'Not at All' (NA) to 'Always' (A). The questionnaire had reliability co-efficient value of $r = .843$. Ten (10)-item semi-structured interview guide with both close and open-ended items were also designed and answered by 20 of the students (Borg, Gall & Gall, 2007). Interview data were validated to ensure trustworthiness (Cohen, Manion & Morrison., 2007; Fraenkel, & Wallen, 2009). The questionnaire instrument enhanced collection of information through a standardized set of questions, that enhanced analysis of relevant trends and patterns in their responses. Finally, its usage prevented biases of all kinds and produced accurate information (David, 2025; Cresswell, 2012; McLeod, 2018). We personally administered both the questionnaire and interview instruments to the student teachers within one week, with a 100% return rate. Twenty (20) of the students were interviewed on one-on-one basis after the collection of the completed questionnaires based on the research questions, with the view to obtaining more in-depth qualitative information to compliment the quantitative data (Questionnaire and Interview Data, August 2024).

Data Analysis Procedures

The questionnaire was scrutinized, coded, scored, analysed, and interpreted in the light of the research objectives using the Statistical Product for Services Solution (SPSS) software programme 26.0. The SPSS was used to summarize reports, charts, frequencies, percentages, means, standard deviations, and correlations. Frequencies, percentages, tables, means, and standard deviations were used to analyse the research questions while the Pearson correlation coefficient (r) was used in analysing the research hypothesis (Devore, 2004; Field, 2009). It was used to quantify the strength and direction of the linear relationship between the variables of the study (accessing RME and its challenges) and also how strongly the two variables change together, whether positively or negatively. The interview data were manually analysed into themes by the researchers after data had been transcribed and reported using narrative style with embedded direct quotations (Braun & Clarke, 2006).

Ethical Considerations

Issues of anonymity, storage of data, confidentiality, informed consent, voluntary participation, and the right of access to relevant data/results were attended to, and reliability issues were dealt with (Merriam, 2009).

Results

The research questions were discussed based on the quantitative and qualitative of the data collected. The findings of the study are discussed in line with the research questions and hypothesis. Descriptive statistics such as frequencies, percentages, means and standard deviations were used in analysing the research questions while the Pearson correlation coefficient (r) was used in analyzing the research hypothesis. The questionnaire consisted of 58 close-ended items, which were structured on a four-point Likert-Type scale of 'Strongly Disagree (SD)' to 'Strongly Agree (SA)' and also from 'Not at All (NA) to 'Always (A)'. The results are presented descriptively in Tables 1, 2, 3 and 4.

RQ1: Kinds of ICT Resources Available to the RME student teachers

Table 1 presents the results of the kinds of ICT resources are available to RME specialism student teachers in UEW) and its affiliate Colleges of Education and this reveals substantial access to key

digital tools and platforms. This research question was answered using responses to items 8-28 in the students' questionnaire. **The results are presented in Table 1.**

Table 1: Kinds of ICT resources are available to the student teachers

ICT Resources <i>Resource</i>	Available		Not Available	
	<i>Frequency</i>	<i>Percentage</i>	<i>Frequency</i>	<i>Percentage</i>
Personal Laptops	179	69.1	80	30.9
Internet Systems	190	73.4	69	26.6
Television	183	70.7	76	29.3
Overhead Projectors	219	84.6	40	15.4
Digital Video Recorder	197	76.1	62	23.9
Digital Cameras	202	78.0	57	22.0
Microsoft Teams	184	71.0	75	29.0
Google Classrooms	210	81.1	49	18.9
Chalkboard.	173	66.8	86	33.2
Video Conferencing	167	64.5	92	35.5
Google Hangouts Meet	169	65.3	90	34.7
Zoom	202	78.0	57	22.0
Moodle/V Class	190	73.4	69	26.6
Big Blue Button	167	64.5	92	35.5
Skype	188	72.6	71	27.4
WebEx	203	78.4	56	21.6
Telegram	179	69.1	80	30.9
Messenger	175	67.6	84	32.4
WhatsApp	176	68.0	83	32.0
WeChat	146	56.4	113	43.6
Smartphones	214	82.6	45	17.4

Source: Fieldwork-Questionnaire Data, August, 2024

From the data in Table 1, a majority of the respondents, 179 out of 259 (69.1%), reported having personal laptops, and 190 respondents (73.4%) indicated they have access to internet systems. These figures suggest that a significant portion of student teachers are well-equipped with the necessary hardware and connectivity to engage in digital learning. Additionally, 214 respondents (82.6%) reported having smartphones, further indicating widespread access to mobile-based learning resources. Digital platforms are also readily available, with 210 respondents (81.1%) reporting access to Google Classroom, and 202 respondents (78.0%) having access to Zoom. These platforms are essential for online instruction and collaboration, highlighting their crucial role in the students' academic activities. Moreover, traditional tools like overhead projectors are accessible to 219 respondents (84.6%), showing that a blend of conventional and modern educational resources is being utilized. However, some ICT resources are less accessible. For instance, video conferencing tools like Google Hangouts Meet and Big Blue Button are available to 169 respondents (65.3%) and 167 respondents (64.5%), respectively. This indicates that over a third of the student teachers lack access to these important tools, which could hinder their ability to participate fully in synchronous online learning environments. Similarly, while 176 respondents (68.0%) have access to WhatsApp, only 146 respondents (56.4%) reported having access to WeChat, pointing to varying levels of access to communication platforms. The data suggests that while most students are equipped with fundamental digital tools, there is a need for more equitable access to a broader range of ICT resources. Addressing these gaps could ensure that all student teachers have the opportunity to fully engage with and benefit from digital learning, thereby enhancing their educational experience and better preparing them for future teaching roles in a technology-driven environment.

Qualitative Interview Data (Results)

As part of the qualitative data collection process, semi-structured interviews were conducted with selected RME specialism students. The interviews were aimed at gaining deeper insights into students' experiences, perceptions, and challenges related to the use of Information and Communication

Technology (ICT) for educational purposes. The abbreviation *ST* followed by a number in the write up is an identity of student teacher respondent. For example, *ST1* means first student teacher interviewee. The data had been analyzed based on four (4) main themes, which also consist of sub-themes. The data were characterized by widespread agreement of the respondents on the issues. There was absolute unanimity in the responses to several of the questions or items and this degree of unanimity gave a lot of power to the results.

Interview Results

Most of the students interviewed indicated the availability of ICT devices such as the Mobile phones, laptops, tablets, Zoom, Google Classroom, Digital Cameras and Microsoft Teams.

The following excerpts provide highlights on the themes under discussion: For, example, item ‘What are some of the ICT devices available to promote your study of RME’?

“Please Sir, some of the ICT devices available to us include Personal Laptops, Internet Systems (Wifi), Google Classrooms, Chalkboard, Overhead Projectors, and Digital Cameras” (*ST 1, Affiliated College, Interview Data, 2024*).

Another student teacher responded that “I have a few of the devices such as a smartphone and a laptop” (*ST 3, UEW, Interview Data, 2024*).

The comments from the respondents (student teachers) indicated that they had in their possession a couple of ICT devices. ICT resources play a major role in the teaching and learning of RME. Teachers become very confident and successful when they have the right amount of such resources to use in their RME lessons. However, it is evident from the comments above that the devices were not adequate in the schools for their usage. In any teacher training institution is very crucial if teaching and learning is to be successful. Student teachers who study RME ought to have some basic ICT resources for their academic work.

RQ2: Extent of ICT Utilization by Students

The analysis of data in Table 2 provides insight into the extent to which RME specialism student teachers at UEW and its affiliated Colleges of Education in Ghana utilize ICT resources in their studies. The mean scores for various ICT-related activities reveal a moderate level of confidence and usage among the students. **This research question was answered using responses to items 29-40 in the questionnaire.** The results are shown in Table 2.

Table 2: RME specialism student teachers’ utilizing ICT resources in studying

Item	N	M	S.D
I am very good at Using ICTs in doing my homework in RME	259	3.24	0.89
I am very good at Using Microsoft Word in writing my project work	259	3.03	0.88
I am very good at Using Microsoft Excel for assessing my own learning of RME	259	2.98	0.94
I have knowledge about use of ICT	259	2.98	0.84
I am very good at Using ICTs to promote my learning of RME (Homework)	259	2.98	0.90
I am very good at Using Microsoft Word for my learning of RME	259	2.93	0.92
I am very good at Using Microsoft Word for Lesson Plan Preparation in RME	259	2.92	0.87
I received pre-service training in ICT education	259	2.89	0.90
I am very good at Using the Internet to research into RME	259	2.83	0.89
I Used ICT tools during my peer teaching of RME	259	2.81	0.90
I Used ICT tools during my (Internship) off-campus teaching practice in RME	259	2.81	0.93
I am very good at Using Microsoft Word in class presentations	259	2.80	1.05
Mean of Means/Standard Deviation		2.93	0.91

Source: Fieldwork-Questionnaire Data, August, 2024

Key: M = Mean, SD = Std. Deviation, Mean of Means Score = 2. 93; Means of Standard Deviations score = 0.91; SD = Strongly Disagree (1.00 – 1. 49), D = Disagree 1.50 – 2.49), A = Agree (2.50 – 3.49, and SA = Strongly Agree (3.50 – 4.00).

Data in Table 2 show the highest mean score of 3.24 for the item “I am very good at using ICTs in doing my homework in RME,” suggesting that students generally feel proficient in using ICT tools for their homework. This is followed by “I am very good at using Microsoft Word in writing my project work,” with a mean score of 3.03, indicating a reasonable level of skill in using this software for academic writing. However, the mean scores decrease slightly for other ICT-related tasks. For instance, “I am very good at using Microsoft Excel for assessing my own learning of RME” and “I have knowledge about the use of ICT” both have mean scores of 2.98. This shows a moderate agreement but not as strong confidence as seen in the highest-scoring item. Similarly, “I am very good at using ICTs to promote my learning of RME (Homework)” also scores 2.98, reflecting consistent but moderate usage. The items related to specific uses of Microsoft Word, such as for learning ($M = 2.93$) and lesson plan preparation ($M = 2.92$), indicate that while students find Microsoft Word useful, there is a slight reduction in perceived proficiency for these tasks. The lowest mean scores are for “I am very good at using Microsoft Word in class presentations” ($M = 2.80$) and “I used ICT tools during my (internship) off-campus teaching practice in RME” ($M = 2.81$), suggesting less confidence or less frequent use in these contexts. Standard deviations for these items range from 0.84 to 1.05, indicating some degree of variability in students’ responses. The lower end of this range (0.84) is observed in items such as knowledge about ICT use, while the higher end (1.05) is seen in “I am very good at using Microsoft Word in class presentations.” This variability suggests that while there is a general trend towards moderate usage and proficiency, individual experiences and competencies with ICT tools vary significantly. Generally, with a mean score of 2.93 and a standard deviation of 0.91, the data indicates a moderate level of agreement on the use of ICT resources among RME specialism student teachers. The variability in responses highlights differences in how effectively these tools are integrated into their academic activities, suggesting areas where further support or training might be beneficial to enhance their ICT skills and usage.

Interview Results

Most of the students interviewed indicated that they regularly used ICT tools to support their academic work. Mobile phones, laptops, and tablets were the most commonly used devices. The use of educational platforms such as Zoom, Google Classroom, and Microsoft Teams was frequently mentioned, especially during online lectures and group assignments. This data show different sub-themes on the level of ICT usage. The following excerpts throw more light on the themes under discussion:

Item: *Item: How do you regularly do you integrate ICT into your study of RME?*

“I use my phone almost every day to join online classes and check assignments on Google Classroom. It has become a routine part of my studies.” – (ST 1, UEW, Interview Data, 2024).

In the same respect, another student teacher from a different college intimated that “We mostly use Zoom for lectures and presentations. It’s easy to use and get access to information on mobile phones.” – (ST 2, Affiliated College, Interview Data, 2024).

The foregoing excerpts and other themes presented on the second research question show that majority of the student teachers used ICT tools to support their academic work but not regularly and intensively. The students need to regularly use these tools to enhance their academic achievements and professional developments.

RQ3: Benefits of ICT Integration

Table 3 illustrates the benefits the RME students were deriving from integrating ICT in their study as contained in research question 3. The data reveals various aspects in which students perceive

benefits from ICT integration, with mean scores ranging from 2.85 to 3.41. **This research question was answered using responses to items 41-54 in the questionnaire.** The results are presented in Table 3.

Table 3: Benefits of integrating ICT in RME by the students

Item	N	M	S. D
Knowledge of different ICT tools for studying RME	259	3.41	0.67
It helps to simplify learning of RME	259	3.28	0.85
I will help me to develop positive attitude towards learning of RME	259	3.27	0.78
It offers a wider choice of learning materials in RME	259	3.21	0.84
It helps improves my communication skills and performance	259	3.20	0.83
It allows me to access the internet	259	3.07	0.98
It helps me to acquire new skills and knowledge	259	3.05	1.01
It helps me become abreast with new technological advancements in RME	259	2.95	0.94
It prepares me for the future and connects better with colleagues	259	2.93	0.90
Handle ICT tools uniquely and effectively	259	2.88	1.01
Be knowledgeable in the use of ICT tools	259	2.85	1.00
Mean of Means/Standard Deviation	259	3.10	0.89

Source: Fieldwork-Questionnaire Data, August, 2024

Key: M = Mean, SD = Std. Deviation, Mean of Means Score = 3. 10; Means of Standard Deviations score = 0.89; SD = Strongly Disagree (1.00 – 1. 49), D = Disagree 1.50 – 2.49), A = Agree (2.50 – 3.49, and SA = Strongly Agree (3.50 – 4.00.

From Table 3 the highest mean score, 3.41, is associated with “Knowledge of different ICT tools for studying RME,” indicating that students feel significantly positive about acquiring knowledge of various ICT tools. This is followed by “It helps to simplify learning of RME” with a mean score of 3.28, suggesting that students find ICT helpful in making the learning process easier. The item “I will help me to develop positive attitude towards learning of RME” also scores high at 3.27, reflecting that ICT integration is perceived as fostering a more positive attitude towards learning. Other benefits include “It offers a wider choice of learning materials in RME” (M = 3.21) and “It helps improve my communication skills and performance” (M = 3.20). These scores indicate that students appreciate the broader range of resources available through ICT and its impact on enhancing their communication skills. The mean scores for items related to accessing the internet (M = 3.07) and acquiring new skills and knowledge (M = 3.05) suggest moderate agreement on these benefits. However, items like “It helps me become abreast with new technological advancements in RME” (M = 2.95) and “It prepares me for the future and connects better with colleagues” (M = 2.93) have slightly lower mean scores, reflecting a lesser but still positive perception of these benefits. The lowest scores are observed for “Handle ICT tools uniquely and effectively” (M = 2.88) and “Be knowledgeable in the use of ICT tools” (M = 2.85), suggesting that students may feel less confident about their ability to effectively handle and be knowledgeable about ICT tools. The overall mean score of 3.10 with a standard deviation of 0.89 indicates a general positive perception of the benefits of integrating ICT in their studies, though there is notable variability in individual responses. This variability, reflected in the range of standard deviations from 0.67 to 1.01, highlights differing levels of perceived benefits and effectiveness of ICT integration among students. The data suggests that while ICT is seen as beneficial in many aspects of their academic experience, there are areas where students may need additional support or training to fully leverage these tools.

Interview Results

The majority of respondents acknowledged that ICT tools significantly enhanced their learning experience. They mentioned benefits such as improved access to information, flexibility in

learning, ease of communication with lecturers and students, and increased engagement during lessons.

These themes are expressed in the following extracts:

“With ICT, I can access notes and videos anytime. It has made learning easier, especially when I miss a class.” – (ST 3, UEW, Interview Data, 2024).

Another student teacher from a different college argued that....

“ICT has made group discussions easier, especially when we are not on campus. We use WhatsApp and Google Meet very often.” – (ST4, College of Education, Interview Data, 2024)

Usage of ICT resources can promote effective learning of RME. Student teachers become very proud of themselves and get maximum satisfaction when they adopt the habit of using such devices in their study of RME.

RQ4: Challenges Faced in ICT Integration/Usage

Table 4 outlines the challenges confronting the RME specialism students in integrating ICT into their studies. The data reveals several key difficulties, with mean scores ranging from 2.62 to 2.98 and an overall mean of 2.77. **This research question was answered using responses to items 55-65 in the questionnaire.** The results are summarised in Table 4.

Table 4: Student teachers' challenges in integrating ICT into their study

Item	N	M	S. D
Flexibility in using ICTs	259	2.98	0.89
Lack of confidence to use ICTs	259	2.88	1.02
Accessibility to technology	259	2.84	0.93
Lack of the needed knowledge to use some ICT tools	259	2.83	0.92
Little Training in the Use of ICT	259	2.82	0.94
Lack of Good Environments for using ICTs	259	2.81	0.93
Unreliable/Unstable Internet Connectivity	259	2.78	0.92
Little Experience in the Use of ICT	259	2.78	0.96
Access to ICTs	259	2.71	0.95
Time Consuming	259	2.69	1.03
Affordability of ICT Devices	259	2.68	1.00
Lack/Inadequate Technical Support	259	2.66	1.03
Health Risks	259	2.66	1.00
Inadequacy of computers for learning	259	2.62	1.02
Mean of Means/Standard Deviation		2.77	0.97

Source: Fieldwork-Questionnaire Data, August, 2024

Key: M = Mean, SD = Std. Deviation, Mean of Means Score = 2. 77; Means of Standard Deviations score = 0.97; SD = Strongly Disagree (1.00 – 1. 49), D = Disagree 1.50 – 2.49), A = Agree (2.50 – 3.49, and SA = Strongly Agree (3.50 – 4.00.

As shown in Table 4, the highest mean score of 2.98 is for “Flexibility in using ICTs,” indicating that while students find some level of flexibility in using ICT tools, it remains a challenge. This is followed by “Lack of confidence to use ICTs” (M = 2.88), suggesting that many students feel uncertain about their ability to effectively use ICT. Challenges related to “Accessibility to technology” and “Lack of the needed knowledge to use some ICT tools” both have mean scores of 2.84 and 2.83, respectively, indicating moderate difficulties in accessing and understanding ICT resources. The scores for “Little Training in the Use of ICT” (M = 2.82) and “Lack of Good Environments for using ICTs” (M = 2.81) reflect challenges in both training and the physical environment for ICT use. Similarly, “Unreliable/Unstable Internet Connectivity” (M = 2.78) and

“Little Experience in the Use of ICT” ($M = 2.78$) highlight issues related to connectivity and experience. Additional challenges include “Access to ICTs” ($M = 2.71$), “Time Consuming” ($M = 2.69$), and “Affordability of ICT Devices” ($M = 2.68$), which are perceived as less significant but still notable. “Lack/Inadequate Technical Support” ($M = 2.66$) and “Health Risks” ($M = 2.66$) also receive relatively lower scores, indicating these are less frequently reported but present challenges. The lowest mean score of 2.62 is for “Inadequacy of computers for learning,” suggesting that while this is a concern, it is less prevalent compared to other challenges. The standard deviations range from 0.89 to 1.03, reflecting a moderate to high variability in responses. The overall mean score of 2.77 and a standard deviation of 0.97 indicate that while challenges are present, their impact varies among students. The data underscores the need for targeted interventions to address these challenges and enhance the integration of ICT in their studies.

Interview Results

While ICT usage was generally high, students reported several challenges. Especially, male students reported higher levels of difficulties integrating ICT into their studies. These challenges included inconsistent internet connectivity, high data costs, limited access to certain software tools, and lack of advanced ICT training. Participants highlighted that while common ICT tools were readily available, access to more specialized resources such as advanced video conferencing platforms and subject-specific educational apps were limited. There was a call for the University and its affiliates to expand the range of accessible ICT tools and provide additional training. These themes are expressed in the following extracts:

“Sometimes, I struggle with internet access, especially when I travel home. It interrupts my studies a lot.” – (*Male student 6, UEW, Interview Data, 2024*).

Another student teacher intimated that

“We don’t really use some tools like WeChat or video editing software because we don’t know how to or they are not common here.” – (*Female student 5, Affiliated College, Interview Data, 2024*).

“We mostly rely on Zoom and Google Classroom. Other platforms are not really promoted or supported here.” – (*Male student, College of Education, Interview Data, 2024*)

Another student claimed that

“There should be workshops on how to use more tools. We only know the basic ones.” – (*Female student, UEW, Interview Data, 2024*).

The inability of the students to acquire some basic ICT logistics and adequately use them for their academic work can be very worrying as this will eventually impede their learning of RME.

Discussion

With respect to the availability of ICT resources, the findings from both the questionnaire and interview results indicate that both student teachers from UEW and its affiliate Colleges of Education have access to a range of ICT resources (See Table 1). These include personal laptops (69.1%), smartphones (82.6%), internet connectivity (73.4%), and digital platforms such as Google Classroom (81.1%) and Zoom (78.0%) that facilitate online learning and collaboration. Traditional teaching tools like overhead projectors (84.6%) are also widely used. However, access to more advanced platforms such as Google Hangouts Meet and Big Blue Button is relatively limited, and there is a notable scarcity of culturally relevant digital content tailored to RME. For example, Student Teacher 1 (ST1) had this to say about the kinds of ICT devices available to

promote their academic work: “Please Sir, some of the ICT devices available to us include Personal Laptops, Internet Systems (Wifi), Google Classrooms, Chalkboard, Overhead Projectors, and Digital Cameras”. This statement was confirmed by an excerpt from Student Teacher 3 (ST3) which indicates that they had some ICT devices for their study of RME: “I have a few of the devices such as a smartphone and a laptop”. This result complements the finding from the quantitative survey. These findings agree with the views of researchers (Abreh & Mankoe, 2022; Agyei & Voogt, 2014; Ameyaw & Antwi, 2017; Amoako & Yeboah, 2024).

The findings from the questionnaire and interview results in relation to the magnitude of integration of ICT resources revealed that while the students in Ghana have access to basic ICT resources such as smartphones, laptops, and software like Microsoft Word and PowerPoint (Owusu-Mensah et al., 2023), the integration of these tools into teaching remains limited. For example, Student Teacher 1 (ST1) from UEW said this about level of usage of the available ICT resources: “I use my phone almost every day to join online classes and check assignments on Google Classroom. It has become a routine part of my studies.” This statement was collaborated by an excerpt from Student Teacher 2 (ST2) from affiliated college, which indicates that they very often employed such devices in their assignments and class work: “We mostly use Zoom for lectures and presentations. It’s easy to use and get access to information on mobile phones.” Institutional ICT facilities such as the computer laboratories, reliable internet, and subject-specific digital content are inadequate (Boateng et al., 2020; Osei & Oppong, 2020), with only a few colleges offering e-libraries and digital repositories (Danso & Amoako, 2021). Although students report moderate proficiency in using ICT for homework and project work (Abreh & Mankoe, 2022), confidence drops in areas like lesson planning, class presentations, and practicum use. These findings agree with the views of Amoako and Yeboah (2024) who indicate the lack of culturally appropriate digital materials for RME further hinders effective use highlighting a pressing need for improved infrastructure, targeted training, and resource development to enhance ICT integration in RME teacher education.

The findings the questionnaire and interview results also indicate that although RME student teachers in Ghana particularly those at UEW and its affiliate Colleges of Education have access to personal ICT resources such as smartphones and laptops, there remains a notable deficiency in institutional ICT infrastructure, including computers, projectors, stable internet access, and subject-specific digital resources (Agyei & Voogt, 2014; Boateng et al., 2020; Danso & Amoako, 2021). The mean of mean score, 3.10 in Table 3 indicating that students feel significantly good in using various ICT tools. Once again, Student Teacher 1 (ST3) from UEW said this in respect of the benefits derived from using ICT in their study of RME: “With ICT, I can access notes and videos anytime. It has made learning easier, especially when I miss a class.” This statement was similar to an excerpt from Student Teacher 4 (ST4) from affiliated college of education that “ICT has made group discussions easier, especially when we are not on campus and we use WhatsApp and Google Meet very often.” While students utilize their personal devices for basic academic tasks like online research and preparing presentations (Owusu-Mensah et al., 2023), the integration of ICT into lesson planning and instructional delivery is still limited. This is largely due to inadequate training and poor infrastructure. Although students generally view ICT as a valuable tool for enhancing learning and improving access to information, many lack the confidence and practical skills necessary for effectively using these technologies in the teaching of RME (Tamakloe & Amedzro, 2025).

Results from the questionnaire and interview were used in answering research question 4. The findings indicate that while some ICT resources such as smartphones, laptops, e-libraries, and projectors are available to the student teachers in Ghana, access remains uneven and inadequate

across Colleges of Education (See Table 4). The mean of means score of 2.77 and /and mean of Standard Deviation score of 0.97 the students were confronted with certain challenges with their ICT usage and this was likely to affect their academic work. Many institutions face challenges including insufficient infrastructure, unstable internet connectivity, and a lack of culturally appropriate digital materials for instruction win RME. Even where resources exist, they are often underutilized due to limited training and practical experience, with students mainly using ICT for basic academic tasks rather than pedagogical applications. These gaps, coupled with weak institutional support and technical barriers, hinder effective ICT integration and highlight the need for targeted investments and subject-specific training to better prepare RME student teachers for modern classroom demands. These results give credence to the views of researchers (Boateng et al., 2020; Danso & Amoako, 2021; Owusu-Mensah et al., 2023; Amoako & Yeboah, 2024) who advocated the existence of ICT devices but pointed out their insufficiency for effective academic work. Although access to basic digital tools is relatively high, many student teachers face challenges in effectively integrating ICT into their teaching due to insufficient pedagogical training and limited institutional support. This underscores the need for strategic investments, structured ICT training programs, and the development of subject-specific digital content to maximize the use of technology in RME instruction

Testing of Hypotheses

H₀: There is no significant difference in the challenges confronting male and female RME specialism students in integrating ICT into their studies at the University of Education, Winneba (UEW) and its affiliate Colleges of Education.

H₁: There is no statistically significant relationship (difference) between non-availability of ICT resources and academic achievements of student teachers offering RME in UEW and its affiliate Colleges of Education in Ghana.

The first research hypothesis sought to measure the strength and direction of the linear relationship between the challenges faced by the students in their ICT usage in terms of gender using the Pearson correlation coefficient (r). An independent samples t-test was conducted to determine if there was a significant difference between these means. In using this statistical tool all relevant assumptions were met because data were continuous, normally distributed, and that the relationship between the variables was linear. Table 5 shows the t-test results of the difference in terms of gender.

Table 5: Differences in challenges in integrating ICT based on gender

Gender	N	Mean	Std. Dev.	T	Df	P
Male	119	39.49	5.00	2.020	257	0.044
Female	140	38.14	5.80			

Source: Fieldwork, 2024

Table 5 displays the differences in challenges of integrating ICT based on gender. The mean score for male student teachers was 39.49 (SD = 5.00), while the mean score for female student teachers was 38.14 (SD = 5.80). An independent samples t-test was conducted to determine if there was a significant difference between these means. The t-test results yielded a t-value of 2.020 with 257 degrees of freedom, and a p-value of 0.044. Since the p-value is less than the significance level of 0.05, the result is statistically significant. The significant p-value (0.044) indicates that there is a significant difference in the challenges confronting male and female RME specialism students in

integrating ICT into their studies. Specifically, male student teachers reported higher levels of challenges compared to their female counterparts.

H₀₂: There is no significant relationship between the challenges faced by RME specialism student teachers in integrating ICT into their studies and the extent of ICT utilization in their educational activities.

Table 6: Relationship between the challenges and ICT utilization

Variable	N	Mean	Sd	R	P
Utilization	259	35.19	5.2	-0.095	0.127
Challenges	259	38.76	5.4		

Source: Fieldwork, 2024

Table 6 presents the data on the relationship between the challenges faced and ICT utilization. The correlation analysis revealed a correlation coefficient (R) of -0.095, indicating a very weak negative relationship between the two variables. The mean score for ICT utilization was 35.19 (SD = 5.2), while the mean score for challenges was 38.76 (SD = 5.4). The p-value associated with this correlation was 0.127. Since the p-value (0.127) exceeds the significance level of 0.05, the result is not statistically significant. Therefore, the null hypothesis was retained. This implies that there is no significant relationship between the challenges confronting the students and the extent of ICT utilization in their educational activities. The challenges faced by these students do not significantly impact the extent to which they utilize ICT resources.

Discussion

The study found that ICT resources, particularly mobile devices and popular platforms like Zoom, Google Classroom, and Microsoft Teams, are widely available to RME specialism student teachers. This aligns with the findings of Aboagye et al. (2020), who noted that tertiary institutions in Ghana are increasingly adopting digital tools for learning. However, the gaps in access to certain tools like WeChat and video conferencing software highlight an ongoing challenge. This is consistent with Adeoye et al. (2020), who identified disparities in access to ICT tools as a significant barrier to equitable learning in Nigeria's tertiary education system. The blended approach observed in the study, combining traditional and digital resources, supports the notion of flexibility in educational delivery, as suggested by Voogt et al. (2013). The moderate proficiency levels in ICT use among RME specialism student teachers suggest that while there is a foundational level of competence, significant room for improvement remains. This variability in skill levels mirrors the findings of Tondeur et al. (2012), who emphasized the importance of continuous training and support to enhance teachers' ICT integration skills. Sang et al. (2010) also pointed out that pre-service teachers' thinking processes and beliefs significantly influence their proficiency and effectiveness in using educational technology. This indicates that targeted interventions may be necessary to bridge the proficiency gap and ensure all student teachers are equipped to utilize ICT effectively in their teaching.

The perception of ICT integration as beneficial for acquiring knowledge and simplifying learning processes aligns with the findings of Ertmer et al. (2012), who highlighted that teacher beliefs about the benefits of ICT play a crucial role in its successful integration. However, the challenges some students face in handling ICT tools indicate a gap in their practical skills, underscoring the need for more comprehensive training. This observation is consistent with the conclusions of Koehler and Mishra (2009), who advocated for the development of Technological Pedagogical Content Knowledge (TPACK) to help teachers effectively integrate technology into their pedagogy. The significant challenges in integrating ICT, such as lack of confidence, accessibility

issues, inadequate training, and unreliable internet connectivity, are consistent with the barriers identified by Awofala and Lawani (2020) in the Nigerian context. These challenges highlight the need for systemic improvements in infrastructure and support, as recommended by Kaur et al. (2020), to facilitate smoother ICT integration in educational activities. Addressing these challenges is critical to ensuring that the potential benefits of ICT are fully realized in the educational experiences of student teachers. The finding of significant gender differences in the challenges faced by male and female students in integrating ICT is supported by the literature on gender and technology use. Vekiri and Chronaki (2008) noted that gender differences in computer self-efficacy and perceived social support can influence how male and female students engage with technology. Kay (2006) also found that gender can impact students' attitudes toward and use of ICT, with male students often reporting higher levels of difficulty. This suggests that gender-specific strategies may be necessary to address these disparities and ensure that all students can effectively integrate ICT into their studies.

The study's finding that there is no significant relationship between the challenges faced and the extent of ICT utilization suggests a degree of resilience and adaptability among the student teachers. Despite the challenges, they continue to use ICT in their studies, which contrasts with the findings of Ertmer et al. (2012), who suggested that significant challenges often hinder ICT integration. This resilience may be attributed to the increasing importance of ICT in education, compelling students to adapt despite the difficulties. However, the lack of a significant relationship also indicates that while challenges are present, they may not yet be substantial enough to impede ICT utilization significantly. This highlights the importance of continued support to prevent these challenges from escalating into more significant barriers.

Findings

1. The availability of ICT resources among RME specialism student teachers is generally high, particularly for mobile devices and widely adopted platforms like Zoom, Google Classroom, and Microsoft Teams. However, the gaps in access to certain resources, such as WeChat and video conferencing tools, indicate areas where additional support may be needed to ensure all students can fully participate in digital learning environments. The relatively high availability of traditional resources like overhead projectors and chalkboards alongside digital tools suggests a blended approach to teaching, combining both conventional and modern methods.
2. The RME specialism student teachers at UEW and its affiliated Colleges of Education generally show moderate proficiency in using ICT resources. Mean scores range from 2.80 to 3.24, with a mean of 2.93 and a standard deviation of 0.91, indicating a moderate level of agreement on their ICT skills. Variability in responses suggests differences in individual experiences and effectiveness in ICT usage.
3. Students perceive various benefits from integrating ICT into their studies, with mean scores ranging from 2.85 to 3.41 and an overall mean of 3.10. The highest benefits include acquiring knowledge of ICT tools and simplifying learning, while areas like handling ICT tools and being knowledgeable show lower scores. The standard deviation of 0.89 reflects some variability in perceived benefits.
4. Challenges in integrating ICT are notable, with mean scores from 2.62 to 2.98 and an overall mean of 2.77. Key issues include lack of confidence, accessibility to technology, inadequate training, and unreliable internet connectivity. The standard deviation of 0.97 indicates moderate variability in the perceived impact of these challenges.
5. The analysis revealed a significant difference in the challenges faced by male and female student teachers in integrating ICT into their studies. Male students reported higher levels of challenges ($M = 39.49$, $SD = 5.00$) compared to female students ($M = 38.14$, $SD = 5.80$).

This indicates that gender significantly influences the challenges encountered, with males experiencing more difficulties than females. The correlation analysis showed a very weak negative relationship between the challenges faced by the students and the extent of ICT utilization ($R = -0.095$). The p-value of 0.127 is greater than the significance level of 0.05, indicating that the relationship is not statistically significant.

Conclusion

While ICT resources are generally available to RME specialism student teachers at the University of Education, Winneba (UEW) and its affiliate Colleges of Education, there are gaps in access to certain tools like WeChat and video conferencing software that need to be addressed to ensure equitable access. The student teachers demonstrate moderate proficiency in using ICT, indicating room for improvement in practical ICT skills. Although ICT integration is perceived as beneficial, challenges such as lack of confidence, inadequate training, and unreliable internet connectivity persist. Notably, male students report greater difficulties in integrating ICT into their studies, suggesting the need for gender-specific strategies. However, the study finds no significant relationship between these challenges and the extent of ICT utilization, indicating resilience among the students but underscoring the need for ongoing support to prevent challenges from becoming more substantial barriers.

Recommendations

Based on the findings of the study, the following recommendations are suggested to University of Education, Winneba (UEW) and its affiliate Colleges of Education:

1. Invest in expanding access to essential ICT resources, particularly tools like WeChat and advanced video conferencing software, to ensure all students have equitable opportunities to participate in digital learning environments.
2. Develop targeted training programs focused on improving practical ICT skills among RME specialism student teachers. These programs should be designed to address the specific needs identified, such as the use of Microsoft Word, Excel, and other essential software.
3. Continuous professional development and support should be provided to student teachers. This could include workshops, mentorship, and access to online resources that help them effectively use ICT tools in their teaching and learning processes.
4. Work on improving infrastructure, especially in areas where access is limited. Collaborating with internet service providers and exploring options like subsidized data packages could also be beneficial. Continue to foster resilience and adaptability among students. This could be achieved by promoting a positive ICT culture, providing stress management resources, and encouraging peer-to-peer support systems.
5. Recognize the gender differences in ICT challenges and develop strategies tailored to the needs of male and female students. This could involve creating support groups, offering gender-specific training sessions, or ensuring that both genders have equal access to resources and support systems. Regular monitoring and evaluation of ICT integration initiatives should be conducted to assess progress, identify emerging challenges, and adjust strategies accordingly. This ensures that the support provided remains relevant and effective in meeting the evolving needs of student teachers.

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RELATIONSHIP BETWEEN PRINCIPALS' NON-CONFRONTATIONAL CONFLICT MANAGEMENT STRATEGY AND TEACHERS' COMPLIANCE WITH DIRECTIVE IN SECONDARY SCHOOLS IN ANAMBRA STATE

Prof. Isaac N. Nwankwo

Department of Educational Management and Policy

Faculty of Education

Nnamdi Azikiwe University, Awka

in.nwankwo@unizik.edu.ng

Abstract

The purpose of the study was to determine the relationship between principals' non-confrontational conflict management strategy and teachers' compliance with Principals' directives in public secondary schools in Anambra State. The study was guided by nine research questions and nine null hypotheses. The correlational research design was adopted. The population of the study was made up of 6,815 teachers while the sample of the study was 2,727 teachers sampled using proportionate random sampling technique. Two instruments developed by the researcher were used for data collection. The first instrument is titled "Principals' Conflict Management Strategies Questionnaire (PCMSQ) while the other is "Teachers' Engagement in School Activities Questionnaire" (TESAQ). The instruments were validated by three experts who are lecturers, one from Measurement and Evaluation, Department of Educational Foundations and the other two were lecturers in Educational Management and Policy, all in Faculty of Education, Nnamdi Azikiwe University Awka. The reliability of the instrument was established using Cronbach's alpha method. Alpha coefficients of 0.78 was obtained in PCMSQ while a coefficient of 0.80 obtained for TESAQ. The researcher administered the copies of the instrument with the help of 5 research assistants each covering the six education zones. The Pearson Product Moment Correlation was used in data analysis, and It was found that and significant relationship existed between non-confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State and it could be linked to the fact that teachers tend to align with non-confrontational style given that it ensures the accommodation of their interest. Based on the findings, it was recommended among others that Ministry of Education should periodically organize seminars and workshops for principals on the need to continually adopt non-confrontational conflict strategy for compliance to principals' directives by teachers.

Keywords: Principals, Non-confrontational; Conflict Management Strategy, Teachers; Compliance; Directives.

Introduction

Every formal organization has stated objectives to achieve. The achievement of the stated objectives is partly dependent on human resources who are different in many ways. The differences in persons are mostly the causes of conflicts in formal organizations. Thus, conflict is an inevitable feature of organizational life which arise due to people's different interests, perceptions, personalities, attitudes, values and views. This leads to differences in opinions in the organization thereby causing conflict. Conflicts are not entirely bad in human organizations. All depend on how the conflicts are handled. Conflicts, when properly managed, are relevant for adjustment in the process of achieving the goals or objectives of the organization. In situations

where they are not properly managed, they hinder the organizational goal attainment. Conflicts are perceived differently by different people.

According to Wilmot and Hocker (2015), conflict is a struggle over perceived incompatible differences in beliefs between two or more interdependent individuals. This may include differences in values, desires for esteem, control, and correctness. Ghaffar (2019) saw conflict as an important and inevitable human phenomenon emanating wherever diverse interests exist. Similarly, Mullins (2020) defined conflict as behaviour intended to obstruct the achievement of some other person's goals. In the same manner, Obi (2021) noted that organizational conflict is an act of discontentment and contention which either the workers or employers of labour employ to put unnecessary pressure against each other so as to get their demands. In a similar vein, Kazimoto (2023) stated that conflict is described as the presence of discord that occurs when goals, interests or values of different individuals or groups are incompatible and frustrate each other's attempt to achieve objectives in an organization.

In contemporary secondary school settings, principals frequently encounter interpersonal conflicts among staff that, if mismanaged, can undermine school harmony and organizational effectiveness. There are several plausible causes of organizational conflicts. Mostly they involve factors such as mismatch of opinions between members of the same team or maybe a difference of understanding between authorities at workplace (Franks et al, 2014). Few reasons for conflicts in organizational environment can be due to structural or non-structural based factor which are:

1. **Poor Communication:** One of the most significant issues of organizational conflicts include poor communication or miscommunication. Different communication patterns often lead to misinterpretation of various topics, which lead to a false impact on the brain regarding the person talking on the topic. This results in a conflicting attitude on the discussion itself. A simple instance such as manager reassigning a worker's task to his/her colleague, but failing to mention it to the concerned worker, or communicating his intentions to the worker before assigning the task, might lead to the employee harboring negative perception about the manager. Repetitive occurrences of this nature in the future might lead to the employee's poor organizational conduct as a whole or towards the manager and might lead to serious organizational conflicts. Thus, it can be observed how miscommunication or absence of proper communication leads to conflict within an organization. Hence, poor communication not only gives rise to conflicts in the workplace itself but also negatively affects productivity of the entire working group (Odle-Dusseau, Britt & Greene, 2022).
2. **Organizational Structure:** The structure wherein an organization is formed plays a very determining role in the conflict area. A simple example can be observed in the fact that in case of a matrix-structured company, decisional conflicts are almost built-in, as it is specified in the structure itself that an employee should report to two bosses (Gelfand et al, 2022). This type of structure will almost always lead to confusion as the company is segmented into smaller parts, always having two opinions on one issue.
3. **Role Ambiguity:** The design of authority in the organizational structure determines the chances of arise of conflict. An ill-defined authority-responsibility relationship will definitely lead to a conflict. The lack of consistency in work is observed when such authority-responsibility relationships are not properly or rather clearly defined. Communication problems creep in and crack open wedges of conflict. Intergroup conflicts are usual results of such weak organizational structures (Sonnentag, Unger & Nägel, 2021).

- 4. Contradicting Personalities:** This encircles one of the most common reasons for conflict in office scenarios. Differences in personality in the workplace are as common and expected as sand on a seashore. Employees come to work from different ethnic backgrounds, having had different experiences and harbor a different and individualistic mindset, thus forming a unique character of each to understand. In the case when one worker fails to understand the other in certain areas or maybe in areas relating to the area of the work assigned to them, conflicts take place (Deyoe & Fox, 2020). A proper instance might include having a straightforward-minded employee who believes in speaking the truth or what he feels directly, without considering the effects of it. This straightforward persona might affect or insult the other workers surrounding if it is such a topic. Sometimes the person with the straightforward attitude might feel offended as well in case the other workers do not behave in that manner with him and keep stuff away from him.
- 5. Frustration and Stress:** Conflict arises in situations where the parties involved are too stressed out or frustrated with their own work. Stressed out people are more likely to start a quarrel with a properly functioning co-worker. This shall in turn reduce productivity on the overall front. Causes of such stress can be as simple as unwanted noise, lack of privacy, untidy workplace, or very serious such as threats of violence, harassment, extreme negative criticism (Riaz & Junaid, 2022).
- 6. Competition Centering Resources:** Resources like equipment, money or time are usually limited and scarce. It is a very natural phenomenon that competition among workers for such resources is a frequent source of conflict. Cutting-edge gadgets and accessories like laptops and iPhones might be allocated to a certain rank of employees whereas others may be deprived of it. Some employees might hold the view that those technical devices are crucial for their productivity and might revolt in extreme cases. This leads to severe competition at times. Such unhealthy competition gives rise to an unethical environment in the office itself, thus lowering the workplace morale as a whole. This in turn demotes teamwork and encourages individualism (Katz & Flynn, 2023).

Difference in Values: Sometimes there exists a certain age gap between the employees at the workplace. Although this is mostly a good thing as the junior get a lot of experience and can as well learn from the senior people, but this also leads to certain conflicts between people sharing a generation gap. The values have changed down the time due to the advancement of society, and the society has become more open and accepting too many new reforms, which may not always sit right with the older generation. The difference in values is not always the harbinger of conflicts but the arrogance to of not accepting such change is. Dealing on the lines of such values, quarrels often breakout and insults only fuel such conflicts (Leithwood, Harris, & Hopkins, 2020).

To navigate the challenges posed by conflicts in schools, many school leaders adopt different conflict management strategies so that the negative effects of conflicts could be minimized or controlled. There exist several strategies that could be used to resolve conflict in schools. These include: dominance, compromise, synergy, culture of civility, win-lose strategy, lose-lose strategy, win-win strategy (Anashie and Kulo, 2020); integration, obliging, smoothing, avoidance, mediation (Best, 2016); dialogue, arbitration, conciliation, diplomacy (Crossfield & Bourne, 2018); negotiation, effective communication, accommodating (Rahim, 2016); non-confrontational, dialogue-control, effective communication (Ogazi, 2021); collaborating, competing, harmonizing (Oshionebo and Ashang, 2017); adjudication, collective bargaining,

confrontation, problem solving, creation of budget committee, separation device, neglect or silence, clarification of inter dependencies, consultation, boxing the problem, clarification of goals, and prayer (Ihwarulam, 2017). Secondary school principals are therefore, open to various strategies to apply in any given conflict situation in their schools. There is no one best conflict management strategy that may be used in all conflict situations. Different conflicts may require different strategies, with the choice of strategy, depending on the nature of the conflict or the parties involved. The focus of this study is on the non-confrontational conflict management strategies, which emphasize empathy, diplomacy, active listening, and at times, strategic avoidance. This strategy aims to preserve relationships and minimize escalation, thereby contributing to a stable and positive school climate (Wilmot & Hocker, 2015).

Non-confrontational conflict management strategies refer to accommodating behaviours that include the passive acceptance of the decision of a partner for the benefit of partner in a conflict episode. Non-confrontational conflict management strategies as (Gunuc, 2013) opined, involve the extent to which individual seek to avoid or downplay the significance of conflict scenarios. These involve letting go in the interest of peaceful co-existence via the avoidance of its discussion. David and Paul (2018) asserted that non-confrontational conflict management strategies are placating in nature. In school situation, the principals yield and give power to teachers to make them feel better. These strategies are used when principals are willing to sacrifice personal interest and convenience to satisfy the needs of others; teachers inclusive. The emphasizes is on maintaining the relationship. It is beneficial when one is mistaken or when you wish to reduce losses since it retains relationships (Amie-Ogan & Eziri, 2021).

Non-confrontational conflict management strategies promote the giving up of the wishes or demands of a party in favor of another (Thote & Gowri, 2020). In other words, it is a 'win-lose' approach. This is where the principals try to meet the needs of all those who are involved in the conflict. For instance, to maximize the teaching time, the principal may demand that remedial lessons be held outside the stipulated teaching time. The school principals view teachers as competent and does not want to lower their morale, they may retain the stipulated teaching time to maintain a good relationship with the teachers.

One widely used non-confrontational technique is avoidance which is deliberately postponing conflict engagement to allow time for emotional cooling or information gathering. While often viewed as passive, in practice, this strategy can serve as a deliberate and tactful method of conflict containment (Tschannen-Moran, 2024). When implemented thoughtfully, such strategies foster emotional safety, mutual respect, and collaborative problem-solving among school staff (Fullan, 2024).

The relevance of non-confrontational strategies becomes even more apparent when considering their impact on teachers' compliance with principals' directives. Compliance in this context refers to the extent to which teachers adhere to the rules, procedures, and instructions issued by school leadership. High levels of compliance are essential for maintaining institutional order, achieving instructional goals, and fostering a culture of professionalism and accountability (Leithwood, Harris, & Hopkins, 2020).

Several interrelated factors influence teachers' compliance, including the clarity of directives, the communication style of the principal, the perceived legitimacy of the principal's authority, and the degree to which teachers are involved in decision-making (Hoy & Miskel, 2022; Robinson, Lloyd, & Rowe, 2018). Notably, the use of respectful and collaborative communication often found in non-confrontational leadership approaches enhances teachers' willingness to follow

directives. This underscores the critical link between conflict management style and teacher behaviour within schools.

Given the complex interplay between leadership style and staff cooperation, this study explored the relationship between non-confrontational conflict management strategies and teachers' compliance with principals' directives in secondary schools. Understanding this relationship is vital for improving leadership practices and promoting a cohesive school environment conducive to teaching and learning.

Statement of the Problem

Given the adverse effects of conflicts on teachers' compliance with principals' directives in the school system, principals who are the administrators adopt several conflict management strategies to influence teachers to comply with directives and take active part in school activities. Ogazi (2021) identified three conflict management strategies that are commonly applied by administrators to include non-confrontation, dialogue-control and effective communication conflict management strategies. Fouts (2021) opined that each of these conflict management strategies has the potential to influence teachers' compliance with principals' directives or disengagement with schools. Where a high level of teachers' compliance with principals' directives is fostered, teachers work jointly with school principals to improve school's effectiveness.

In public secondary schools in Anambra State, it is quite unfortunately that most teachers do not comply with principals' directive or engage actively with school activities and this is one of the problems challenging secondary school growth in the State. Accordingly, the researcher's interaction with many school students revealed that some teachers in their various schools hardly comply with principals' directives or engage in school activities. They go to school at will, involve in private business practices during school hours, and give out notes to students to copy without teaching. Further interactions indicated that there are many rivalries among the teachers in the schools. Expressing concern over the dangers of lack of compliance with principals' directives and teachers' disengagement with school, Ucheoma (2024) noted that teachers' disengagement and non-compliance with principals' directives are leading manifestations of indiscipline among teachers. Falae and Onofeghara (2017) were of the opinion that the standard of students' academic work is decreasing in quality as a result of teachers' indiscipline. In many secondary schools in Anambra State, there are seemingly high levels of teachers' non-compliance with directives of their principals which manifest in gross indiscipline among the teachers, rivalry with the principals, truancy and laxity towards class work, loitering and absenteeism from classes and engagement in private business practices during school hours (Ogbonnaji & Ucheoma, 2024). The grave implications of these manifestations of teachers' non-compliance with directives have warranted this study into the variables that are often blamed for the teachers' indiscipline in school.

At this juncture, it is reasonable to argue that teachers' non-compliance with principals' directives is the major cause of lack of cooperation among staff which in turn, hinders the attainment of school objectives. Could the cases of lack of teachers' compliance with directives be associated with strategies the principals adopted in managing conflicts? In other words, is there any relationship between principals' non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State? The concerns of this study were to provide answers to these questions by empirically investigating whether the non-confrontational conflict management strategies adopted by school principals have significant

relationship with teachers' compliance with principals' directives in public secondary schools in Anambra State.

Research Question: What is the relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State?

Research Hypothesis: There is no significant relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State.

Research Method

It's a correlation study, carried out in public secondary schools in Anambra State. The population of the study was made up of 6815 secondary school teachers in the six education zones in Anambra State. The composition of the population based on education zones include: 1657 teachers in Awka zone, 1254 teachers in Onitsha zone, 1047 teachers in Aguata education zone, 1122 teachers in Nnewi zone, 1097 teachers in Ogidi zone, 638 teachers in Otuocha zone. The data were obtained from Post Primary Secondary School Commission (PPSSC, 2023). Simple random sampling technique was used to draw the sample of 2727 teachers in the six education zones using 40%, which 2340 data were recovered.

Two instruments developed by the researcher were used. The first instrument is titled "Principals' Conflict Management Strategies Questionnaire (PCMSQ) and while the second is tagged "Teachers' Engagement in School Activities Questionnaire" (TESAQ). The instrument was validated by experts. The reliability of the instrument was established using Cronbach alpha method and co-efficient values for PCMSQ and TESAQ were 0.78 and 0.80 respectively. The questionnaire was administered to the respondents in their various schools with the help of research assistants. Pearson Product Moment Correlation was used to analyse data.

Research Question: What is the relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State?

Table 1: Pearson's Product Moment Analysis of the Relationship Between Non-Confrontational Conflict Management Strategy and Teachers' Compliance with Principals' Directives in Secondary Schools in Anambra State

Variables	N	R	p-value	Remark
Non-Confrontational Management Strategy	2340	.221	0.04	Moderate Positive Relationship
Teachers' Compliance with Principals' Directives				

Results in Table 1 show the Pearson's coefficient $r = (.221)$. This therefore indicated that there is a moderate positive relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State. Thus, principals non-confrontational conflict management strategy has a moderate positive relationship with teachers' compliance with principals' directive in secondary schools in Anambra State.

Research Hypothesis: There is no significant relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State.

Table 2: Pearson r on relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives.

Source of Variation	N	R	p-value	Remark
Non-Confrontational Management Strategy	2340	0.540	0.04	Moderate Positive Relationship
Teachers' Compliance with Principals' Directive				

Data in Table 2 show that there is a moderate positive relationship existing between non-confrontational conflict management strategy and teachers' compliance with principals' directives. This is evident by the size of Pearson's Correlation Coefficient r , which is 0.540. Furthermore, the analysis shows that there is a significant relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives. The calculated r (0.540) has p -value <0.05 . The null hypothesis two was therefore rejected.

Discussions of Finding

Based on the finding of the study, it showed that a moderate positive and significant relationship existed between non-confrontational conflict management strategy and teachers' compliance with principals' directives. This could be linked to the fact that teachers tend to align with non-confrontational style given that it ensures the accommodation of their interest. Consistent with the finding of the current study, Thote and Gowri (2020) observed that non-confrontational conflict management strategies promote the giving up of the wishes or demands of a party in favour of another. In other words, it is a 'win-lose' approach. This is where the principals try to meet the needs of all those who are involved in the conflict. Here, the school principals view teachers as competent and does not want to lower their moral, they may retain the stipulated teaching time to maintain a good relationship with the teachers. This, to all intents and purposes, promotes teachers' compliance with principals' directives.

Summary of Finding

A moderate positive and significant relationship existed between non-confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State.

Recommendation

This suggestion is made to improve teachers' compliance with principal's directive

1. The ministry of Education should organize regular workshops for principals, emphasizing the importance of continually using non-confrontational conflict management strategy in order to encourage and improve teachers' compliance with principals' directive.

Conclusion

The adoption of non-confrontational conflict management strategy by principals plays a vital role in fostering teachers' compliance with principals' directives. By cultivating an atmosphere of mutual trust, respect, and inconclusiveness, principals are able not only to address conflicts effectively but also strengthen teachers' professional commitment and promote overall school improvement.

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IN-SERVICE TRAINING PROGRAMME AND ACADEMIC STAFF PRODUCTIVITY IN OYO STATE COLLEGES OF EDUCATION FOR SUSTAINABLE DEVELOPMENT

Akinpade Oyejoke Adunola

Department of Curriculum and Instruction,
Oyo State College of Education, Lanlate
oyejokeakinpade@gmail.com

Senimetu Ileuma

Department of Educational Management
Faculty of Education,
Lead City University Ibadan
Oyo State, Nigeria

Abstract

This study was carried out on in-service training programme and academic staff productivity in Oyo state colleges of education for sustainable development. The study was hinged on human capital theory. Two research questions and one hypothesis were created to guide the work. Descriptive survey research design was used. Study population consisted of 1,058 academic staff 4,593 year three students. Yamane sampling formula was used to sample 290 academic staff and 368 year three students. Two self-designed instruments tagged: In-service Training Programme for Sustainable Development Questionnaire, ITPSDQ ($\alpha = .793$)” and “Academic Staff Productivity for Sustainable Development Questionnaire, ASPSDQ ($\alpha = .793$)” were used to gather data. Data gathered was analysed using descriptive and inferential statistics. Results showed moderate level of academic staff productivity ($\bar{x} = 3.102$) and in-service training ($\bar{x} = 2.780$) for sustainable development in Oyo state colleges of education. There was a positive significant correlation between in-service training programme and academic staff productivity for sustainable development ($r = .316, P < .05$). It was concluded that moderate level of in-service training significantly influence the moderate level of academic staff productivity in colleges of education in Oyo state. It was recommended amongst others that in-service training should be improved upon for better academic staff productivity and sustainable development.

Keywords: Academic Staff Productivity, In-Service Training, Sustainable Development

Introduction

Sustainable development is the ability of societies to get their present needs met without endangering the ability of the next generations to get their needs met (Mazza, 2021). Sustainable development entails an ideal socio-economic set-up which guarantees the viability of goals in areas of enhancement of real income, health care, educational standards, and general standard of living of a people (Klarin, 2018). Sustainable development, which is the social, environmental, and economic development of a society is needed in contemporary times so as to ensure developing nations are able to catch up with their counterparts (developed nations). For sustainable development to be achievable in a developing nation like Nigeria, there is need for effective in-service training and productivity of manpower (academic staff) in institutions such as colleges of education (Shobayo & Ajayi, 2023).

Adedayo (2017) posited that the issue of productivity among colleges of education academic staff cannot be overemphasized because it makes them to effectively and efficiently use all available resources such as time, knowledge, people, information, equipment, effort and materials to attain the goals of the institution. Academic staff who are productive will achieve much in their academic duties such as instruction, supervision and publication with minimal amount of resources (Ezeabii et al., 2021). Since, colleges of education are institutions created with the aim of training and equipping teachers especially for the nation's primary and secondary educational system, the productivity of academic staff in the colleges for sustainable development therefore becomes an important concept to look into.

Productivity of academic staff (which include all the lecturers of various academic cadre such as chief lecturer, principal lecturer, senior lecturer, lecturer I, lecturer II, lecturer III and assistant lecturer) is a measure of the quantity and quality of work done, considering the amount of resources or inputs used in carrying out instruction, supervision and publication in colleges of education, Oyo State (Zayum et al., 2018). Instructional productivity occurs when academic staff at colleges of education are able to effectively prepare and deliver lectures as scheduled by the timetable, evaluate students by giving and marking coursework, set tests and examinations, invigilate and mark them, submit their results/marks for final assessment, grade and accredit students' scores with minimal amount of resources (Assessment Handbook, 2021). Publication/supervision productivity is when academic staff in colleges of education are able to effectively carry out investigations on identified problem(s), present findings of such investigations in conferences/seminars, publish findings in journals and/or text books and supervision of students' projects with minimal amount of resources (Agbionu et al., 2018).

Despite the crucial role of academic staff performance, the researcher has observed that their job productivity in areas of instruction and publication/supervision in colleges of education, Oyo state seems to be poor or average. Literature is replete with evidence of poor to average level of productivity of academic staff in teaching and research in colleges of education in Oyo state (Aransiola & Sanjo, 2021; Abiodun-Oyebanji, 2023; Oke, 2023; Oladeji, 2023). If this poor job productivity of academic staff of colleges of education is allowed to continue, the goal of raising teachers for the nation's primary and secondary schools for sustainable development may not be achieved. Although, previous studies have examined factors such as teamwork, stress management strategies, work indices and environmental factors, there are however scarcity of studies on salient factors such as in-service training programme (Aransiola & Sanjo, 2021; Abiodun-Oyebanji, 2023; Oladeji, 2023).

In-service training deals with imparting the required and essential skills and knowledge to enable an academic staff perform his or her job well and solve real life problems for sustainable development. In-service training is also the process by which academic staff ability to execute a task for sustainable development is enhanced through acquisition of skills, knowledge and positive attitude necessary for harmonious co-existence in the school (Tijani, 2019). Offering in-service training to academic staff is crucial in determining the extent to which a college of education intends to achieve its academic goals for sustainability (Maclean, 2018; Tijani, 2019). It was suggested that when colleges of education can recruit, train, and then retain skilled academic staff, the overall stability of the institution is maintained, both in terms of productivity and financial viability which enhances sustainable development (Tijani, 2019).

Studies have shown that staff development programmes, capacity building, and in-service training influence academic staff job performance in public universities and colleges of education in Rivers State, Southwest, and Northwest geopolitical zones of Nigeria (Ahmed, 2018; Agbonna et al.,

2022; Osuji et al., 2022). However, there are dearth of studies on in-service training and academic staff productivity in Oyo state colleges of education for sustainable development. It therefore becomes imperative to investigate in-service training and academic staff productivity in Oyo state colleges of education for sustainable development in a bid to addressing this gap in literature.

Statement of the Problem

Despite the crucial role of academic staff productivity for sustainable development, poor to average level of productivity of academic staff in teaching and research have been observed and reported in colleges of education in Oyo state (Aransiola & Sanjo, 2021; Abiodun-Oyebanji, 2023; Oke, 2023; Oladeji, 2023). The implication of low to below average academic staff job productivity is the poor quality of teachers or graduates produced into our schools which could invariably affect students' academic performance in the long run. If this is not checked it could lead to increase in half-baked teachers in both primary and secondary schools which could hamper the students' foundation and sustainability (Shehu et al., 2015). Perhaps, in-service training may be responsible for the poor to average productivity of academic staff in the colleges. This is because of the role that manpower development plays in effectiveness of workers at their duties. Although in-service training is a salient factor that could predict academic staff productivity, there are scarcity of studies on its influence on academic staff productivity. Hence, this study was carried out to investigate the extent to which in-service training influences academic staff productivity in Oyo state colleges of education for sustainable development in a bid to closing this identified gap in literature.

Aims and Objectives of the Study

The aim of this study was to investigate in-service training programme and academic staff productivity in Oyo state colleges of education for sustainable development. Specifically, the objectives were to:

- a) identify the level of academic staff productivity for sustainable development in Oyo state colleges of education;
- b) ascertain the level of in-service training programme for sustainable development in Oyo state colleges of education; and
- c) examine the relationship between in-service training programme and academic staff productivity for sustainable development in Oyo state colleges of education.

Research Questions

The following research questions were raised to guide the study:

1. What is the level of academic staff productivity for sustainable development in Oyo state colleges of education?
2. What is the level of in-service training programme for sustainable development in Oyo state colleges of education?

Hypotheses

H₀₁: There will be no significant relationship between in-service training programme and academic staff productivity for sustainable development in Oyo state colleges of education.

Significance of the Study

The findings of this study should be of immense benefit to educational stakeholders like colleges of education administrators, educational policy makers, academic staff, researchers, and government at both state and federal level and the general public. This study should provide an insight to college administrators on in-service training programme and academic staff productivity in Oyo state colleges of education for sustainable development. This in turn should guide them on how best to ensure that lecturers are properly trained in line with productivity and sustainability.

In addition, the study's findings should assist the educational policy makers to make policies that will aid the productivity of the academic staff in terms of suitable training that enhance sustainable development.

The findings of the study should equally keep academic staff abreast of how to improve their job productivity that ensures sustainability. The findings should also enable them to make sure they readily undergo training that boost their productivity but make them pursue sustainable development goals. This study should serve as a guide to the educational researchers and be a vital point of reference for researchers to further investigate in this area of study. The findings would inform the government on the necessity of allocating funds to cater for training for sustainable human development.

Scope of the Study

This study was basically on in-service training programme and academic staff productivity in Oyo state colleges of education for sustainable development. The variable scope consisted of one independent and one dependent variable. The independent variable was in-service training for sustainable development while the dependent variable was academic staff productivity for sustainable development. The geographical scope for this study was public colleges of education in Oyo state. The population scope included all academic staff and 300L students at the colleges of education. The methodology scope included – descriptive research design, use of questionnaires for data collection and descriptive and inferential statistics for data analysis.

Literature Review

Theoretical Review

This study was guided by the “human capital theory”, premised on neo-classical analysis of labour markets, education and economic growth. The theory assumes that academic staff are productive resources and explores whether more highly educated/trained academic staff are more productive than others (Ahmed & Brennan, 2019). More importantly, the human capital theory is a cost and benefit analysis of educational investment. From this viewpoint, training represents an investment in human capital (academic staff) that can be justified if net returns are generated in terms of better skills and increased performance (Tharenou et al., 2007).

Human Capital Theory is a framework that examines the relationships between education, economic growth, and social well-being (sustainable development). It is an extension of the capital concept and posits that expenditures on education, job training (in-service training programmes), and health are capital investments that will yield economic and social returns at the individual and societal levels for sustainable development (Becker, 1994). Education and job training are assumed to lead to greater productivity, which is ultimately translated into improved economic returns such as higher wages and increased GDP and overall sustainable human and national development (Schultz, 1961).

Conceptual Framework

Figure 1 below demonstrated the relationship between the independent (in-service training for sustainable development) and dependent variable (academic staff productivity for sustainable development).

Independent Variable

In-service training for sustainable development

Dependent Variable

Academic staff productivity for sustainable development

Figure 1: Conceptual Framework**Methodology**

A “descriptive survey research design” was adopted to carry out this study. In this research design, the variables of study were not manipulated. The population of the study comprised all the academic staff and 300 level students of Federal and State public colleges of education in Oyo state. As at the year 2024, there are three public colleges of education in Oyo state with a total of one thousand and fifty eight (1,058) academic staff (including Heads of Department) and four thousand, five hundred and ninety three (4,593) year three students as shown in table 1.

Table 1: Population for the Study (1,058 academic staff; 4,593 300L students)

S/N	South West State	S/N	Public Colleges of Education	Ownership	Academic Staff	Number of 300L Students	TOTAL
1.	Oyo	1	Federal College of Education (Special), Oyo	Federal	571	1977	2548
		2	Emmanuel Alayande College of Education, Oyo	State	347	2114	2461
		3	Oyo State College of Education, Lanlate	State	140	502	642
TOTAL				3	1,058	4,593	5,651

Source: Establishment records office and Academic planning units of the Colleges of Education (2024)

Yamane sampling technique was used to sample two hundred and ninety (290) academic staff and three hundred and sixty-eight (368) 300L students. The formula by Yamane (1967) is shown below:

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size, and e is the level of precision which is the level of significance at 0.05.

Two researcher constructed questionnaires were used to collect data for the study. The instruments were tagged: “In-service Training Programme for Sustainable Development Questionnaire (ITPSDQ)” and “Academic Staff Productivity for Sustainable Development Questionnaire (ASPSDQ)”. Content and face validity evidence was used to validate the questionnaires in order to ensure that they measure what they are supposed to measure. Cronbach’s alpha reliability method was used to determine the internal consistency (reliability) of the instruments. Reliability coefficients of .793 and .742 were derived for ITPSDQ and ASPSDQ, respectively. These reliability values when subjected to the psychometric test were found to be reliable.

The instruments were administered to the sampled academic staff and 300L students personally and with the help of two research assistants. After administration, descriptive and inferential statistics were used to analyse the data gathered. Demographic information of the participants was

subjected to descriptive statistics such as frequency counts and percentage. Research questions were answered using descriptive statistics of frequency counts, percentage, mean and standard deviation. Hypotheses one (H_{01}) was tested using inferential statistics such as Pearson product moment correlation (PPMC) at 0.05 level of significance.

Results

Frequency Distribution of the Demographic Information of Participants

Table 2: Academic Staff Demographic Distribution (n = 290)

Demographic Information	Frequency (F)	Percentage (%)
Ownership of Colleges of Education		
Federal	157	54.1
State	133	45.9
Gender		
Male	149	51.4
Female	141	48.6
Age		
Below 30 years	26	9.0
30-39 years	54	18.6
40-49 years	93	32.1
50-59 years	101	34.8
Above 60 years	16	5.5
Highest Level of Education at Present		
Bachelor's degree	103	35.5
PGD	34	11.7
Master's degree	107	36.9
MPhil degree	17	5.9
PhD degree	29	10.0
Rank		
Chief Lecturer	25	8.6
Principal Lecturer	32	11.0
Senior Lecturer	37	12.8
Lecturer I	44	15.2
Lecturer II	56	19.3
Lecturer III	54	18.6
Assistant Lecturer	42	14.5
Length of Service		
0-4 years	40	13.8
5-9 years	78	26.9
10-14 years	83	28.6
15-19 years	51	17.6
Above 20 years	38	13.1

Field Survey, 2024

Table 2 showed that 54.1% of the academic staff are in federal college of education while 45.9% are in state college of education. 51.4% of the staff are males whereas 48.6% are females. Most (34.8%) of the staff are within 50-59 years of age whereas a major portion of them (36.9%) have Master's degree. Majority of the staff (19.3%) are lecturer II in terms of cadre while most of them (26.9%) have 5-9 years in their length of service.

Table 3: 300L Students Demographic Distribution (n = 368)

Demographic Data	Frequency (F)	Percentage (%)
Gender		
Male	168	45.7
Female	200	54.3
Age		
Below 20 years	222	60.3
20-25 years	92	25.0
Above 25 years	54	14.7

Field Survey, 2024

Table 3 shows that 45.7% of the students are males whereas 54.3% are females. However, most of the students (60.3%) are less than 20 years of age.

Answers to Research Questions

Research Question One: What is the level of academic staff productivity for sustainable development in Oyo state colleges of education?

Table 3: Level of Academic Staff Productivity for Sustainable Development (n = 368)

S/N	Items (My lecturers)	VHL	HL	ML	LL	VLL	Mean ($\bar{x}$)	S.D
1	take the pain to explain and re-explain what they teach with minimal amount of resources that ensures attainment of sustainable development goals like quality education	14 (3.8%)	80 (21.7%)	181 (49.2%)	76 (20.7%)	17 (4.6%)	2.995	.76
2	manage time efficiently, attend lessons regularly according to the time-table that ensures sustainability	18 (4.9%)	83 (22.6%)	152 (41.3%)	94 (25.5%)	21 (5.7%)	2.954	.77
3	ensures that continuous assessment (CA) are marked on time and released to students before examination commences in a bid to ensuring quality in higher education	27 (7.3%)	42 (11.4%)	189 (51.4%)	77 (20.9%)	33 (9.0%)	2.872	.80
4	have published at least 20 research articles in national and international journals in the past 3 years in such a manner that ensures sustainable research output	49 (13.3%)	126 (34.2%)	130 (35.3%)	44 (12.0%)	19 (5.2%)	3.386	.70
5	supervise research students allocated to them as scheduled in a manner that boosts sustainable development such as research quality, and standard education	70 (19.0%)	89 (24.2%)	126 (34.2%)	48 (13.0%)	35 (9.5%)	3.302	.72
Weighted $\bar{x}$ (Std. Dev.) = 3.102 (0.75)		Overall Decision = Moderate Level						

Source: Field Work, 2024

Key: Very High Level (VHL) = 5, High Level (HL) = 4, Moderate Level (ML) = 3, Low Level (LL) = 2 and Very Low Level (VLL) = 1;

Mean Threshold: If the mean is 0.000-1.499 = Very Low Level; 1.500-2.499 = Low Level; 2.500-3.499 = Moderate Level; 3.500-4.449 = High Level; 4.500-5.0000 = Very High Level

Table 3 generally revealed that the level of academic staff productivity for sustainable development in Oyo state colleges of education is moderate (**Weighted $\bar{x}$ (Std. Dev.) = 3.102 (0.75)**).

Research Question Two: What is the level of in-service training programme for sustainable development in Oyo state colleges of education?

Table 4: Level of In-service Training for Sustainable Development (n = 290)

S/N	Items	VHL	HL	ML	LL	VLL	Mean ($\bar{x}$)	Std. Dev.
1	On-going training is organized for academic staff in my school in order to ensure sustainable quality education	21 (7.2%)	41 (14.1%)	75 (25.9%)	105 (36.2%)	48 (16.6%)	2.593	.87
2	Academic staff are sponsored by my school to embark on courses related to teaching and sustainable development goals	19 (6.6%)	29 (10.0%)	84 (29.0%)	99 (34.1%)	59 (20.3%)	2.483	.90
3	Meetings and study groups are created for academic staff by the school to help them improve in their knowledge and skills for the attainment of sustainable development goals	49 (16.9%)	58 (20.0%)	95 (32.8%)	74 (25.5%)	14 (4.8%)	3.186	.75
4	The content of the training course is relevant to my teaching activity and sustainability requirements	39 (13.4%)	58 (20.0%)	82 (28.3%)	45 (15.5%)	66 (22.8%)	2.859	.84
Weighted $\bar{x}$ (Std. Dev.) = 2.780 (0.84)		Decision = Moderate Level						

Source: Field Work, 2024

Key: Very High Level (VHL) = 5, High Level (HL) = 4, Moderate Level (ML) = 3, Low Level (LL) = 2 and Very Low Level (VLL) = 1;

Mean Threshold: If the mean is 0.000-1.499 = Very Low Level; 1.500-2.499 = Low Level; 2.500-3.499 = Moderate Level; 3.500-4.449 = High Level; 4.500-5.0000 = Very High Level

Table 4 generally revealed that the level of in-service training programme for sustainable development in Oyo state colleges of education is moderate (**Weighted $\bar{x}$ (Std. Dev.) = 2.780 (0.840)**).

Test of Hypotheses

H₀₁: There will be no significant relationship between in-service training programme and academic staff productivity for sustainable development in Oyo state colleges of education

Table 5: Pearson Product Moment Correlation for In-service Training and Productivity

In-Service Training Programme	Academic Staff Productivity	
	Pearson Correlation	.316*
	Sig. (2-tailed)	.008
	N	290

*r value is significant at the $P < 0.05$ level (2-tailed).

The above result reveals a positive significant correlation between in-service training programme and academic staff productivity for sustainable development in Oyo state colleges of education ($r = .316$, $P < .05$).

Discussion of Findings

This section discusses previous scholarly works related to the topic of discourse (in-service training and academic staff productivity in Oyo state colleges of education for sustainable development). Answer to research question one (What is the level of academic staff productivity for sustainable development in Oyo state colleges of education?) showed that the level of academic staff productivity for sustainable development in Oyo state colleges of education is moderate. This finding is in disagreement with that of Abiodun-Oyebanji (2023) who revealed in a study that the level of lecturers' research output in Colleges of Education in Southwestern Nigeria is low. Differences in the results could be that the former study was conducted in colleges of education in the entire southwest whereas the latter was carried out in colleges of education in only Oyo state. This finding also disagrees with that of Agbonna et al. (2022) which revealed that the level of lecturers' job performance in state owned universities in South-West Nigeria is high. The differences observed in both results could be that the former study was conducted in universities in the entire southwest whereas the latter study was carried out in colleges of education in only Oyo State. This result slightly disagrees with that of Abazie (2020) which revealed that the level of teachers' job performance in public secondary schools in Enugu State, Nigeria is above average. Differences in the results could be that the former study was conducted in public secondary schools in Enugu state whereas the latter was carried out in colleges of education in only Oyo State.

Answer to research question two (What is the level of in-service training programme for sustainable development in Oyo state colleges of education?) showed that the level of in-service training programme for sustainable development in Oyo state colleges of education is moderate. This result slightly disagrees with that of a study which revealed that the level of in-Service Training in Public Secondary Schools in Enugu State, Nigeria is above average (Abazie, 2020). Differences in the results could be that the former study was conducted in public secondary schools in Enugu state whereas the latter was carried out in colleges of education in Oyo state. This result slightly disagrees with that of Maclean (2018) which revealed that the level of in-service training in public senior secondary schools in Rivers State is above average. Differences in the results could be that the former study was conducted in public secondary schools in Rivers State whereas the latter was carried out in colleges of education in Oyo State.

Hypothesis one revealed a positive significant correlation between in-service training programme and academic staff productivity for sustainable development in Oyo state colleges of education. This finding is also supported by that of a study which showed significant relationship between staff development programmes on job performance of academic staff in public universities in Rivers State (Osuji et al., 2022). Similarities in the results could be that they were both carried out

among academic staff in tertiary institutions in Nigeria. This result corroborates that of a study which revealed that in-service training such as conferences, workshops, seminar and intensive training significantly influenced job performance of lecturers in Colleges of Education in North-West Zone, Nigeria (Ahmed, 2018). Similarities in the results could be that they were both carried out in colleges of education in Nigeria (North-West and Southwest Zones in Nigeria).

A study on “Impact of Training Programmes on Job Performances of Staff in Nigerian Colleges of Education: A Strategy for Full Productivity and Sustainable Development in Nigeria” showed a significant influence of Training Programmes on Job Performances of Staff in Nigerian Colleges of Education (Shehu et al., 2015). Similarities in the results could be that they were both carried out in colleges of education in Nigeria. This result significantly relates to that of Gyot et al. (2023) whose results showed that In-Service Training Programmes significantly improves staff job performance in colleges of education in Nigeria. Similarities in the results could be that they were both carried out in colleges of education in Nigeria.

Conclusion and Recommendations

Based on the results of this study, it is concluded that the moderate level of in-service training could be responsible for the moderate level of academic staff productivity in colleges of education in Oyo state for sustainable development.

On the basis of the results and conclusion of the study, it can be recommended that:

- i. More attention should be given to academic staff productivity so as to improve it from moderate to a high or very high level for better training of teachers for the nation’s primary and secondary school educational sectors for sustainable development
- ii. All kinds of in-service training such as seminars, conferences, workshops and etcetera should be improved from a moderate to a high or very high level so as to boost academic staff productivity for sustainable development.
- iii. In-service training should be done more regularly to enhance academic staff productivity for sustainable human and national development.

Suggestions for Further Research

A mixed study could be used for further study. Demographic data of the academic staff such as their age, gender and qualifications may be used as intervening variables in further studies. This study should be done in other states in the nation to substantiate the results and for generalisation too. Research designs other than the one used in this study could be employed in further studies.

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ARTIFICIAL INTELLIGENCE (AI) INNOVATION AND SECONDARY EDUCATION IN OYO STATE: NEED FOR REASSURING MEASURES FOR SUSTAINABLE DEVELOPMENT (SD)

Oluwatoyin Isaiah AWOLOLA Ph.D

Department of Educational Management,

Emmanuel Alayande University of Education, Oyo. Oyo State

awololatoyin2017@gmail.com

Abstract

In recent times, the contemporary Artificial Intelligence (AI) innovations have brought new possibilities to the world. However, in the school setting, it seems poor technology is a limitation to effective teaching and learning. This study, therefore, investigated the Artificial Intelligence (AI) innovation and Secondary Education in Oyo State with a view to establishing the need for adopting measures for sustainable development (SD). The research design used was a descriptive survey. The population for the study was all teachers in all public secondary schools in Oyo State. The study adopted a multi-stage sampling technique. All the 3 senatorial districts (Oyo North, Oyo South and Oyo Central) were purposively selected for equal representation. From each, 2 Local Government Areas (LGA) were selected through a random sampling technique. A total of 30 public secondary schools 5 from each LGA, through a random sampling technique. A total of 150 classroom teachers (5 from each school) were selected through a random sampling. A structured questionnaire titled "Artificial Intelligence (AI) Innovation and Secondary Education toward Sustainable Development Questionnaire (AIISEDQ)" was used, and a 4-likert scale type was adopted to elicit data. Simple percentages were used to answer 5 research questions. Findings revealed that averagely, the level of knowledge of AI innovation among the students in public secondary schools in Oyo State was 13.33% while 86.67% were not aware of AI innovation. Also, AI was found to be inadequately in use. Despite being an instrument of educational sustainability, it has many limitations. Recommendations were made that the state government should embrace the new emerging AI innovation in secondary education by make it compulsory for the students in all the schools all over the state. Need for general information on AI innovation. Also, ICT centers in all secondary schools should be equipped with functional systems and manpower.

Keywords: Artificial Intelligence (AI), Secondary education, Reassuring Measures, Sustainable Development (SD), Technology

Introduction

AI systems are machine-based systems that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. They are designed to operate with varying levels of autonomy. Globally, Artificial Intelligence (AI) is the one of the latest elements of the Fourth Industrial revolution. The development of AI systems and technologies in what has been referred to as the "4th Industrial Revolution" has ushered in new opportunities and threats to all nations especially developing countries. AI provides opportunities for the "global south" to leap attain economic growth and prosperity. While it is forecasted that AI could add over US\$15 trillion to the global economy in just 10 years, it is clear that the benefits of this 4th revolution will not be evenly accrued by developing countries and in fact, may bypass them altogether without deliberate policies, strategic action, and collaboration between relevant stakeholders.

Concept of Artificial Intelligence (AI)

The terms ‘AI’ or ‘AI system’ refer to digital and/or data-driven technologies, such as those used for automated decision making, diagnosis, predicting and forecasting and pattern recognition. The systems, comprising both software and hardware, are designed by with a complex goal to act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting collected structured/ unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal (High Level Expert Group on Artificial Intelligence, HLEG, 2019).

Chen and Hwang (2020) revealed that “AI has extensively been adopted and used in education, particularly by education institutions, in different forms”. Lee (2019), in his examination of the role and the use of AI in the fourth industrial revolution, emphasised that “AI education in the industrial revolution era should play a leading role in the central role of character education, and intrinsic improvement of various human lives”. They can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments, operating with varying levels of autonomy. . AI also holds great promise to address other sustainable development goals (SDGs) particularly those faced by individuals at the “bottom of the pyramid” by providing AI-as-service solutions or generating data on micro-levels using mobile phones and other electronic devices. It also provides a useful tool for assessment of needs and the targeted delivery of development interventions. Various surveys of global readiness for AI innovations have found African countries, particularly those in sub-Saharan Africa, to be mostly not ready to take advantage of the technology revolution for economic growth and development (Oxford Insight’s, 2020) in UNESCO/ARETE (2024). In the AI Readiness Index (2024), which assesses how well governments are positioned to take advantage of AI transformation, Nigeria ranked 138 of 172 countries globally.

The integration of Artificial Intelligence (AI) in education offers substantial benefits, transforming traditional teaching approaches and enhancing the overall learning experience. Personalised learning, a key advantage of AI in education, allows tailored content delivery based on individual student needs and learning preferences. This approach fosters a more effective and engaging learning environment by accommodating diverse learning styles and pacing (Federal Ministry of Education, FME, 2006). Moreover, AI significantly improves efficiency in education by automating routine tasks. Automated grading systems, administrative processes, and data analysis contribute to time savings for educators, enabling them to focus more on personalized instruction and student support.

In the opinion of (Gocen, 2020), the benefits of AI include helping individual at learning at their own speed, correct determination of the individual's need, reduced (if not absolutely eliminated) paperwork in schools, prevention of waste of time, increase in education quality, providing ease of work, helping the right decisions with fast data analysis, ability to train in smaller groups with effective planning and more effective individual learning process. It also helps policymakers, for example, population prediction simulations for making the right education investments.

However, many challenges may emanate in adopting AI in education. These can range from malpractices as the students may take this advantage, to cheating during examination, plagiarism as many researchers may use the intelligence system to solve for any problem and publish without much effort and undoubtedly reduce professional skills (Annuš, 2023). Artificial intelligence will equally reduce greatly the curiosity to learn by the students as many of them will prefer to solve any task being given using AI instead of searching different materials to solve a particular educational problem. In this regard, AI is seen to encourage indolence among students. In furtherance to this, Blerta, Florije and Agron (2024) stressed that ethical concerns loom large,

particularly in the realms of data privacy and the potential for biases in AI algorithms, raising questions about fairness in educational outcomes.

Concept of Sustainable Development Education

The proposed Sustainable Development Goals (SDGs) on education was the 4th goal. It ensures “inclusive and equitable quality education and promote life-long learning opportunities for all”. Sustainable Development Goal 4 encapsulates a more ambitious and transformative education agenda. This includes enabling all young people to complete a basic education cycle including quality pre-primary education; acquiring knowledge, skills and competencies for work, entrepreneurship and life; experiencing good quality teaching and inclusive classroom practices; and accessing educational opportunities based on equity, flexibility and adaptability. The targets outlined in this proposed goal would not only guide the world towards progress across many education outcomes. Nonetheless, achieving the goal would facilitate sustainable social and economic development for countries and communities (Williamson, 2020).

Sustainable Development in Education has been seen as medium of future development. When learning starts in infancy, achievement and attainment are greater in primary school and beyond. Stimulating children’s cognitive development early has large positive effects on children’s future trails. Previous studies from Latin America, sub-Saharan Africa and South and South-east Asia showed consistent positive impacts on child development when children’s cognitive development was stimulated. Access to education is a necessary but not sufficient condition for education to positively impact development outcomes. Where children are not learning due to poor quality, they are more likely to repeat grades and ultimately drop out.

Since education has been described by UNESCO (2015) in Babalola and Awolola. (2016) as a key to SDG 4, Education 2030 Agenda is also a window of opportunity for inclusive education. This according to UNESCO will help take care of human rights and common good, pay attention for groups with special needs, take care of exclusive and marginalisation. According to Inclusive Design Research Centre (2015), quality AI education is a fundamental part of the new sustainable development goal agenda where children receive quality basic education and most vulnerable are taken care of. This could promote sustainable development in the country. Successful SDE and AI education happen by accepting, understanding, and attending to students’ difference and diversity, which include: the physical, cognitive, academic, social and emotional spheres of live (Tailor & Kumar, 2021).

Need for Reassuring Measures for Sustainable Development (SD)

Furthermore, AI technologies can adapt assessments based on individual student interactions, leading to more personalized feedback that can guide students more effectively in their learning processes. The accuracy of AI assessments not only enhances the reliability of results but also supports institutions in identifying and addressing learning gaps. In addition, Baker and Green (2020) and Zhao (2021) submitted that the most critical benefit provided by AI in the context of rapidly expanding educational systems. AI technologies enable institutions to manage larger volumes of assessments without the need to proportionally increase the number of teaching or administrative staff (Eluemuno, Anokam, Ipem, Eluchie, and Mary, 2022). This adaptability helps in maintaining a balance between challenge and skill level, crucial for keeping students engaged and motivated. Moreover, AI systems can incorporate various learning modalities, such as visual aids and interactive content, which cater to different learning styles, thereby enhancing comprehension and retention rates (Chen & Hwang, 2020).

Del Gobbo, Guarino, Cafarelli and Fontanella (2023) examined the latent factors impacting students’ attitude toward online/blended learning during the pandemic. 2,420 students were

sampled and interviewed after two years of COVID-19 emergency education. It was revealed that the overall attitude of students towards online learning was positive, though several features are shown to be playing some roles in influencing this attitude. The specific findings are that students with higher motivation and engagement with professors are more prone to favor online learning, while students with higher engagement with classmates and worse pandemic emotional impact exhibit a lower level of satisfaction. Furthermore, considering contingency factors, commuter and working students display a more positive attitude, but the ones enrolled in Scientific-Technological courses show a lower level of satisfaction with online learning.

Many Nigerian education institutions have begun integrating technology into their operations and educational methodologies. E-learning platforms, management information systems, and computer-based testing are increasingly prevalent, reflecting a growing recognition of technology's potential to enhance educational delivery and administration (United Nations (2015). Interventions include the adoption of learning management systems such as Moodle, which some Nigerian institutions use to manage course content and facilitate remote learning. There has also been an increase in the use of software like combat plagiarism and ensure academic integrity.

Furthermore, institutions are experimenting with AI-driven systems to automate administrative tasks and personalise learning experiences, although such initiatives are still in their infancy (Dike, 2022). AI and sustainable education have enhanced access to educational resources, improved learners' efficiency, and provided new avenues for academic integrity. Additionally, the effectiveness of these technologies varies widely across institutions due to disparities in implementation capacity and infrastructure. As UNESCO (2019) notes put "global engineering education today is largely focused on scientific and technological courses that are not intrinsically related to the analysis of human values nor are overtly designed to positively increase human and environmental wellbeing.

It is similarly important to provide opportunities for learners to learn and develop on what AI is, how it works, and entry points for influence over its development, and its use to advance their goals (UNESCO/SDG Policy, 2017). AI-driven assessments, characterised by their ability to automate and personalise evaluation processes, are increasingly acknowledged for their potential to address key challenges in higher education sectors globally, including those in developing countries like Nigeria (Baker, Smith & Green 2020).

The Need for AI-Driven Assessment in Secondary Education

AI-driven assessment tools are designed to minimise human errors and biases that traditionally affect the grading process. Through sophisticated algorithms, AI can analyze students' responses with a high level of precision, ensuring that grading is consistent and fair across different sets of students (Johnson, 2021). Furthermore, AI technologies can adapt assessments based on individual student interactions, leading to more personalised feedback that can guide students more effectively in their learning processes (Smith & Doe, 2022). The accuracy of AI assessments not only enhances the reliability of results but also supports institutions in identifying and addressing learning gaps. One of the most compelling arguments for adopting AI in education is the significant increase in operational efficiency it offers (Baker & Green, 2020). This automation extends to the administrative aspects of assessment management, including the organisation of results and analysis of data patterns to improve teaching strategies and course content (Zhao, 2021).

AI-driven tools can significantly enhance student engagement by providing instant feedback and interactive learning environments that keep students actively involved in their learning process. AI can also address inclusivity by adjusting assessments and content to be accessible for students

with disabilities or those who need special accommodations, thus supporting a broader commitment to inclusive education (Barrera & Reyes, 2022). Beyond direct educational impacts, AI-driven assessments contribute to broader institutional efficiency. They enable educators and administrators to streamline operations, reduce redundancy, and allocate resources more effectively. Furthermore, the strategic insights gained from AI analytics support better decision-making regarding program development, student support services, and long-term planning (Lee & Nguyen, 2021).

However, on the other hand, limitations arise due to inconsistent electricity supply, inadequate digital literacy among staff and students, and financial constraints limiting the acquisition of necessary hardware and software. Additionally, the effectiveness of these technologies varies widely across institutions due to disparities in implementation capacity and infrastructure (Obioma & Adeniji, 2021).

Theoretical Framework: Connectivism Theory by George Siemens (2005)

Connectivism Theory, introduced by George Siemens (2005), asserts that learning occurs through forming connections within network of information, people and technology. It supports AI's roles in creating network learning environments for sustainability education. By aggregating environmental data, AI enables students to analyse trends and propose solutions, fostering global citizenship and collective action. The theory focuses on networked aligns with the study vision of AI-driven toward sustainability. Social Constructivism explains teaching and learning as social phenomena between lecturers and learners. It is a clear departure from the idea that lecturers are custodians of knowledge, instead the theory considers teachers as facilitators in the learning process. Advocates of this theory believe that learning is about finding solutions to problems and that the social construction of solutions is the essence of the learning process (Picciano, 2017).

In other words, problem-solving through collaboration is the primary objective of social constructivism. In the view of social constructivist, teachers could develop social relationship with their students to support their remote learning during the school closure. Connectivism is often referred to as the learning theory for the digital era, as it describes how people learn in today's "technology-driven" society (Srivastava, 2018).

According to Siemen (2005), knowledge does not only reside in the mind of a person but it in a distributed manner across a network. This study regards the connectivist viewpoint as the most relevant learning paradigm in this current situation where students are confined to learning at home with A1 devices. Firstly, connectivism theory captures the importance of the online collaborative learning and sharing in this age. Secondly, social constructivism primarily focusses problem-solving through collaboration. That is teacher is seen as modifier of education. Also, connectivism is the only theory that recognises the presence of the internet and best explains how people learn in the era of ever-increasing and rapidly changing information due to technology advancement and the ubiquitous access to the Internet.

Statement of the Problem

Over time, Nigerian secondary education has gone through various limitations. This poses several significant challenges that impact its functionality and efficacy. Despite the recent global innovation of AI innovation, Nigerian government is confronted with resource limitations and perhaps the most pervasive, with many secondary institutions facing underfunding, which affects their ability to maintain infrastructure, procure necessary technology, and retain qualified staff. It seems the students' poor knowledge and uses diversity pose challenges in terms of varied educational backgrounds and learning needs, and this do not accommodate good academic learning outcomes.

These limitations have become increasingly sophisticated and undermining the credibility of the educational system and necessitating urgent and effective solutions. Need for inclusion of AI innovation into secondary education calls for urgent attention. Previous studies focused on AI and its limitations, AI and Nigeria education, AI and returns and Need for AI in the society among others. This study, therefore, examined Artificial Intelligence (AI) and Secondary Education in Oyo State: Need for Reassuring Measures for Sustainable Development (SD)

Objectives of the Study

The explored Artificial Intelligence (AI) innovation and secondary education in Oyo State, with a view to establishing the need for reassuring measures for sustainable development. Specifically, the study was to:

1. Discern the extent of awareness of AI innovation among the students in public secondary schools in Oyo State;
2. Identify the various benefits of AI innovation toward educational sustainable development in public secondary schools in Oyo State;
3. Ascertain the limitations of AI innovation among the students in public secondary schools in Oyo State; and
4. Proffer remedies to limitations of AI innovation among the students in public secondary schools in Oyo State.

Research Questions

The following research questions were raised and answered:

1. What is the extent of awareness of AI innovation among the students in public secondary schools in Oyo State?
2. What are the various benefits of AI innovation toward educational sustainable development in public secondary schools in Oyo State?
3. What are the limitations of AI innovation among the students in public secondary schools in Oyo State?
4. In what ways can these limitations of AI innovation be solved among the students in public secondary schools in Oyo State?

Methodology

The research design used was a descriptive survey. The population for the study was all teachers in all public secondary schools in Oyo State. The study adopted a multi-stage sampling technique.

Step 1: *Three senatorial districts (Oyo North, Oyo South and Oyo Central) were purposively selected through the purposive sampling technique. Step 2:* *In each district, 2 Local Government Areas (LGA) were selected through a random sampling technique. A total of 6 LGA were used. Step 3:* *In each LGA, 5 public secondary schools were randomly selected through a random sampling technique for the study. A total of 30 public secondary schools were selected.*

Step 4: *In each school, 5 classroom teachers were selected through a random sampling technique.*

Step 5: *A total of 150 classroom teachers were used for the study.*

Table 1: Sample Description for the Sample

Senatorial District	Local-Government Sampled	School Sampled	Teachers Sampled
Oyo Central	2	10	50
Oyo North	2	10	50
Oyo South	2	10	50
Total	6	30	150

Structured questionnaire titled "AI and Students' Academic Achievement Questionnaire (ASAAQ)" was used to elicit data and a 4-likert scale type was adopted. Validation was done by experts in Educational Management while the instrument reliability was carried out using Alpha Cronbach and 0.84 was obtained. The data analysis was based on simple percentage analysis.

Results and Discussions

Table 1: Demography Data of the Respondents

Variables	Frequency	Percentage
Sex	70	46.67
Male		
Female	80	53.33
Age	57	38.00
20 - 30 Years		
31 - 40 Years	33	22.11
41 - 50 Years	20	13.20
51 - 60 Years	28	18.48
Above 60	12	7.92
Educational Qualifications	52	34.32
First Degree		
Second Degree	90	60.30
Third Degree	8	5.36
Years Of Teaching Experience	32	21.44
1- 10		
11- 20	61	40.67
21 -30	50	33.50
Above 30	7	4.69

From table 1, on the sex distribution, it was found that there were 70 male and 80 female representing 53.30% and 46.70% respectively. Also, on the age distribution, age 20-30 years were 57 (38%). 41-50 years (13.20%) while above 60 were 12 (7.92%). On education, 52 (34.32%) respondents had first degree, 90 (60.30%) had second degree while 8(5.36%) respondents had Ph.D. However, on the years of experience, majority 61(40.67%) had 11-20 years while 7(4.69%) were above 30 years.

Research Question 1: Are the students knowledgeable (conversant) about AI innovation among the students in public secondary schools in Oyo State?

Table 2: Students' Knowledge about AI innovation

S/N	Items	SA	A	D	SD
1	Students have understanding of AI as the latest technology	0 (0.00%)	0 (0.00%)	0 (0.00%)	150 (100%)
2	Complexity of information about AI discourage students awareness on AI	100(66.67%)	50 (33.30%)	0(0.00%)	0(0.00%)
3	Students have not heard much about AI innovation	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
4	Students do not comprehend the added value of AI to their education	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
5	Students believe that AI is only for businessmen	120 (80.00 %)	30 (20%)	0(0.00%)	0(0.00%)

No of Responses = 150 Total Responses = 750 Knowledgeable = 650 Not Knowledgeable =150

From table 2, the students' knowledge about AI innovation in public secondary schools in Oyo State is shown. The findings revealed that all the 150 (100%) respondents strongly disagreed that students were not conscious of AI as the latest technology, strongly agreed that students have not heard much about AI and that students do not comprehend the added value of AI to their education. In addition, 100 (66.67%) respondents strongly agreed that teachers' poor information about AI discourage students' awareness on AI. More so, 120 (80.00%) respondents strongly agreed that students believed that AI is only for business. Averagely, the extent of knowledge of AI innovation among the students in public secondary schools in Oyo State was 13.33% (i. e. 150 respondents) while 86.67% respondents did not have knowledge of AI innovation.

Research Question 2: What are the various benefits of AI innovation toward educational sustainable development in public secondary schools in Oyo State?

Table 4: Benefits of AI Innovation toward Educational Sustainable Development

S/N	Items	SA	A	D	SD
1	AI transforming traditional teaching approaches and enhancing the overall learning experience	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
2	AI allows tailored contents delivery based on individual student needs and learning preferences	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
3	AI fosters a more engaging learning, diverse learning styles & achieving educational objectives.	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
4	AI helps learners in learning at their own pace, meet their needs and prevention of waste of time	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
5	AI increases education quality, provide ease work, help in the right decisions & effective planning	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)

From table 4, the benefits of AI innovation among the students in public secondary schools in Oyo State are displayed. The findings revealed that all the 150 (100%) respondents strongly agreed that AI transforming traditional teaching approaches and enhancing the overall learning experience, AI allows tailored contents delivery based on individual student needs and learning preferences and AI fosters a more engaging learning, diverse learning styles and achieving educational objectives. Also, they submitted that AI helps learners in learning at their own pace, meet their needs, prevention of waste of time, AI increases education quality, provide ease work, help in the right decisions and effective planning.

Research Question 3: What are the limitations of AI innovation among the students in public secondary schools in Oyo State?

Table 5: Limitations of AI Innovation among the Students

S/N	Items	SA	A	D	SD
1	Adopting AI in education can be ranging from misconducts during tests/examination	140 (100%)	10(0.00%)	0(0.00%)	0(0.00%)
2	Plagiarism effects as many researchers may use the AI to & publish verbally which is reduce professional skills	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
3	AI equally reduce greatly the curiosity to learn they will prefer not to search to solve a particular educational problem	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
4	AI is seen by students as too complex, thus encourage indolence/ inactivity among them.	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
5	Ethical concerns such as realms of data privacy and impending biases in AI algorithms, raising questions about fairness in educational outcomes.	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)

From table 5, limitations of AI innovation affecting the students in public secondary schools in Oyo State is shown. The findings revealed that all the 150 (100%) respondents strongly agreed that AI could lead to misconducts during tests/examination, plagiarism effects as many researchers may use the AI to publish verbatim, and equally reduce greatly the curiosity to learn they will prefer not to search to solve a particular educational problem. In addition, AI is seen by students as too complex, thus encourage indolence/ inactivity among them and ethical concerns such as realms of data privacy and impending biases in AI algorithms.

Research Question 4: In what ways can these limitations of AI innovation be solved among the students in public secondary schools in Oyo State?

Table 6: Ways these limitations of AI innovation be solved among the students

S/N	Items	SA	A	D	SD
1	Need for conducive school environment to enhance better uses of AI	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
2	Teachers should arrange and allow good classroom management.	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
3	There is need for adequate infrastructural facilities	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
4	Class room size should be standard (Avoid rowdy)	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)
5	Need for the state government to support the AI innovation (funding) in the public secondary schools	150 (100%)	0(0.00%)	0(0.00%)	0(0.00%)

Providing ways forward to these limitations of AI innovation among the students in public secondary schools in Oyo State. It was found that there is need for conducive school environment to enhance better uses of AI, Teachers should arrange and allow good classroom management and need for adequate infrastructural facilities. Also, class room size should be standard and state government to support the AI innovation (funding) in the public secondary schools

Discussion of Findings

From the findings, the respondents pointed to the level of knowledge of AI innovation among the students in public secondary schools in Oyo State. It was revealed that students were not conscious of AI as the latest technology. This is because they had not heard much about AI and comprehend the added value of AI to education. In addition, they strongly agreed that poor information about AI discourage students' responsiveness on AI. Averagely, the extent of familiarity of AI innovation among the students was too low. This is in line with the view of Del Gobbo, Guarino, Cafarelli and Fontanella (2023) that latent factors impacting students' attitude toward online/blended learning during the pandemic emergence. It was found that 2,420 students after two years of COVID-19 emergency education.

The benefits of AI innovation toward educational sustainable development are numerous. The respondents submitted that AI is transforming traditional teaching approaches, enhancing the overall learning experience, allows tailored contents delivery based on individual student needs. They also agreed that it fosters, achieving educational objectives, and increases education quality as well as help in right decisions and effective planning. This study is in line of Oxford Insight's (2020) in UNESCO/ARETE (2024) that AI holds great promise to address other sustainable development goals (SDGs) particularly those faced by individuals at the "bottom of the pyramid" by providing AI-as-service solutions or generating data on micro-levels using mobile phones and other electronic devices. The knowledge of AI enhances access to quality STEM education and careers for girls and women. United Nations Programmes for Development (UNPD, 2006).

The limitations of AI innovation among the students create a great challenge to students' academic. The findings revealed that adopting AI in education can lead to misconducts during tests/examination, plagiarism effects which could reduce professional skills. It can also encourage indolence among them and create biases in AI algorithms, raising questions about fairness in educational outcomes. This is in relation with the study of Annuš (2023) that many challenges may be emanated in adopting AI in education, ranging from malpractices as the students may take this advantage to cheat during examination. In furtherance to this, Blerta, Florije, and Agron (2024) stressed that ethical concerns loom large, particularly in the realms of data privacy and the potential for biases in AI algorithms, raising questions about fairness in educational outcomes.

The way out to the limitations of AI invention were identified by the respondents in public secondary schools in Oyo State. Majority of the respondents pointed to need for conducive school environment, teachers should arrange and allow good classroom management and provision of adequate infrastructural facilities to enhance better uses of AI. More so, class room size should be standard (Avoid rowdy) and need for the state government to support the AI innovation (funding) in the public secondary schools. This is justified by George (2005) that learning occurs through forming connections within network of information, people and technology. It supports AI's roles in creating network learning environments for sustainability education.

Conclusion

The integration of Artificial Intelligence (AI) in education offers substantial benefits, transforming traditional teaching approaches and enhancing the overall learning experience. Personalized learning, a key advantage of AI in education, allows tailored content delivery based on individual student needs and learning and assist in educational goals attainment. The usage of innovation in teaching and learning in educational institutions makes students expand knowledge, experience, and increase understanding, especially in the use of visual, audio, maps, video presentations, and so on. More so, innovation makes the teaching and learning process more interesting, encouraging, and effective. It has also been established that innovation encourages students to process information better, which enhances their understanding, improves their memories Thus, teachers should put more effort into using AI innovation in classroom in order to increase students' achievements.

Recommendations

- For effective implementation of AI innovation in Oyo State and Nigeria at large, there must be a comprehensive approach involving policy reform, infrastructure development, collaboration and ethical considerations
- ICT centers should be provided by the state government and be equipped with functional systems and manpower. Thus, embrace the new emerging AI invention in education.
- There is need for collaborative efforts between government, academia, and the private sector to drive the sustainable adoption of AI in education.
- Need for the policy-makers and educational planners to formulate better technological education policies that are universally relevant to secondary education.
- There is a need for mass literacy programme (orientation) to educate the students on the current AI innovation, about its origin, its uses, benefits and limitations.

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STAFF DEVELOPMENT AND INCENTIVES AS PREDICTORS OF PUBLIC SECONDARY SCHOOL TEACHER'S PRODUCTIVITY IN OYO SOUTH SENATORIAL DISTRICT, OYO STATE, NIGERIA

Okemakinde Timothy (Ph.D)

Department of Educational Management,
Emmanuel Alayande University of Education,
Oyo, Oyo State, Nigeria.
okemakindetimothy@gmail.com

Abstract

This study investigated factors determining teacher's productivity in public secondary schools in Oyo South Senatorial District, Oyo State, Nigeria. Descriptive survey research design was adopted for the study. One Thousand and Fifty (1,050) teachers were used as respondents. Instrument used for the study was tagged "Teachers Productivity Questionnaire (TPQ)" (0.82). Data were analysed using multiple regression, at 5% level of significance. Findings revealed a significant joint contribution of staff development (seminars, workshops, conferences and referral courses) on teacher's productivity in public secondary schools in Oyo South Senatorial District, Oyo State ($F_{5, 1204} = 2.602, P < 0.05$). It further revealed a significant joint contribution of incentive strategies (salary increment, regular promotion, bonuses, awards and condition of service) on teacher's productivity in public secondary schools in Oyo South Senatorial District, Oyo State ($F_{4, 624} = 2.614, P < 0.05$). It is thus recommended, based on the findings, that Oyo State government should lay more emphasis on organising workshops, seminars and conferences to improve public secondary school teachers' competency and productivity. It should ensure that annual leave bonus and salary increment are paid promptly. Emphasis should be placed on periodic promotion exercise and the financial commitment should be enhanced. There should also be improved condition of service to motivate and enhance teachers' productivity.

Introduction

The wealth of a nation lies not only in the abundant material resources but also in the quality of her human resources, as it is the human resource that determines the success of any organisation be it private or public. This is so because it is through human productivity that other resources are organised and utilised to achieve desired results. Therefore, the efficiency of any organisation depends to a large extent on its human productivity. In the words of Ekpo and Ndum (2021), a highly productive workforce is a valuable strategic asset for the organisation. Ekpo, Monity and Eyo (2024) state that productivity is a measure of how well resources and skills are utilized for accomplishing a set result. It includes the effective and efficient utilisation of all resources. It also measures the efficiency of a person, machine and system in converting inputs into useful outputs.

Teachers are the heart and soul of educational programmes as they are the ones who ensure that the goals of the educational system are realised through the various services they render. In the words of Odok, Ekpo, Onabe and Osaji (2024), teachers' productivity in schools is very important, not only for growth of the schools but for the growth of the nation at large. The achievement of quality education rests on the shoulders of teachers who need appropriate motivation to produce the desired educational productivity. Given the fact that education is one of the important factors that help in bringing about rapid social and economic development in any given nation, the role of teachers cannot be over-emphasised. Thus, concerted efforts should always be made through

effective and efficient motivational strategies to ensure teachers' productivity in the school system.

Incentives are those things put in place by various organisations or institutions to motivate, compensate and reward performance of employees such as salary increment, regular promotion, job security, condition of service and so on. When these are offered to employees it may influence them to extend more effort in any given task which can lead to higher productivity and the attainment of institutional goals and objectives (Onabe, Ekpo, Akuh & Edoho, 2024). One way through which employers can retain the workforce is through offering a good compensation package. Educational institutions can only be successful in its retention strategy if it offers competitive, market-related pay and benefits because this motivates teachers to become committed to the institution. Teachers will remain in the institution if they are rewarded; and they may leave if they are poorly rewarded. Employees are likely to stay in organizations where they believe that their capabilities, contributions and efforts are appreciated. Ali and Anwar (2021) assert that employees' satisfaction is generally considered as the driver of the employees' retention and productivity. Satisfied employees are a pre-condition for increasing productivity, responsiveness, quality, and recognition service.

Akinwumi (2000), in Mohammed, Onu and Dalhatu (2022), maintained that the relationship between motivational style and productivity depends primarily upon the interaction and understanding of the leader's behaviours with subordinate characteristics. In summary, he realised that the employee-oriented pattern of leadership tends to enhance employee satisfaction. The concern for teachers' productivity is crucial because of its apparent direct relationship with the standard of education. In essence, teachers must be motivated to be able to deliver their best. Chandrawaty and Widodo (2020) are of the opinion that since incentives play a major role in employees' productivity, individual talents alone would not enable them to operate at a high level of efficiency unless there is an incentive structure in place that motivates them to work harder.

Kassim and Onyango (2022) found a strong correlation on the use of teacher performance incentives to boost their productivity. These relationships were found to be related to teachers' performance and increased effort as well as student learning outcomes. Adelekan (2020) findings revealed a significant difference in teachers' incentives (condition of service and fringe benefits) and teachers' performance in school. This is a strong justification for rewarding teachers because of the complexity of the teaching profession, its relationship to student outcomes, and the substantial influence that student outcomes have on students' prospects for future development. Kassim and Onyango (2022) reported that teachers who received incentives reported higher student performance than those who did not as it significantly motivated them to put more effort for improved students' academic achievement. The study of Abubakar (2024) revealed that an effective rewards system motivated and propelled employees to better performance and that lack of fringe benefit for teachers led to poor teacher responsiveness.

Maclean (2018) investigated the relationship between in-service training and teachers' job performance in public senior secondary schools in Rivers State. Major findings of the study showed strong positive and significant relationships between teachers' learning, growth, needs, collaboration and job performance in public senior secondary schools in Rivers State, Nigeria. It was concluded that staff development in general had positive impact on teachers' job performance in public senior secondary schools. Khan and Abdullah (2019) investigated the impact of teacher training and development on their productivity and performance in classroom teaching and in their administrative work as well. The study concluded that there existed a positive and strong relationship between training and teachers' productivity. Panagiotopoulos and Karanikola (2017) research results showed that majority of participants recognized the contribution of training to job

satisfaction and productivity. Paposa and Kumar (2019) examined the relationship and impact of training and development practices on job satisfaction and teacher's productivity. The results depicted a positive relationship between training and development practices and job satisfaction among the faculty members of institutes. The study not only provides empirical credence to the importance of training and development practices but also has implications for the management of educational institutes to conduct a proper training need analysis to ensure that appropriate training and development practices are adopted leading to creating a learning environment in public secondary schools. This would eventually contribute to job satisfaction of teachers through appropriate skills development for teachers and public secondary school growth and development.

Abazie (2020) study showed a significant relationship between teachers' professional in-service training, workshop training, conference attendance and job performance in public secondary schools in Enugu State, Nigeria. From the study, it was concluded that in-service training had a strong positive correlation on teachers' job performance in public secondary schools. Sharp-Akosubo and Amamilo (2020) investigated in-service training and secondary school teachers' job satisfaction in Rivers State, Nigeria. Major findings of the study revealed that forms of in-service training such as correspondence courses, regular courses, conferences, workshops, distance learning or self-study, seminars, exhibitions were all significant on teachers' job satisfaction and productivity. All the percentage of the sampled teachers agreed that in-service training inculcated new ideas and innovation on them, which directly affected their teaching skills positively. The study concluded that teachers who take part in in-service training tend to acquire relevant teaching skills which could enhance their satisfaction with teaching. The development of teachers through in-service training is essential to the nature of their commitment to work, job satisfaction, and enhanced productivity.

Umar (2017) investigated the influence of in-service training needs on the job performance of teachers in Colleges of Education for sustainable development in North-West geo-political zone, Nigeria. Findings of the research revealed significant influences of teachers' conferences and workshop on their job performance. Based on this, it was concluded that in-service training improved teachers' job performance in Colleges of Education in North-West geo-political zone, Nigeria. Mduma and Mkulu (2021) sought to find out the influence of teachers' professional development practices on their job performance. The findings revealed that training the workforce had the most impact on various dimensions like improvement in teaching strategies, effectiveness and personal, reduction in teachers' burnout, stress and turnover. This implied that regular performance appraisals in schools enabled teachers to improve themselves in classroom management, simplifies supervision, evaluation and assessment process, improves proper communication and it also ensures teachers' discipline at work.

Chukwuemeka, Iremeka, Aneke, Ozioko, Muhammad and Nweke (2021) assessed the impact of school teacher training and development on teachers' job performance and retention among secondary schools in South-East, Nigeria. Finding of the study revealed that implementation of personnel policy of training and development enhanced teachers' job performance on the job and also significantly contributed to teacher retention among secondary schools in South East, Nigeria. Iwuagwu and Aiwuyo (2017) investigated the effects of in-service training on effective classroom control and teacher-students' relationship in secondary schools in Edo State, Nigeria. Findings of the study showed that in-service training significantly influenced effective classroom control and teachers-students' relationship.

Statement of the Problem

Public secondary school teachers' level of productivity in Oyo South Senatorial district, Oyo State, Nigeria is seriously dwindling due to inadequacies in staff development programmes and

motivational strategies. It has been documented that major gaps that often occur in public secondary schools are poor teachers' remunerations, poor bonuses, inadequate in-service-training programmes, conferences, referral courses, irregular promotion and poor reward system. This situation leads to morale dampening, frustration and indiscipline which is affecting the level of teachers' productivity in the school system. This has led to inability or difficulty in accomplishing the overall objectives of the school system.

The inadequacies in staff development and incentives strategies often cause poor coordination and create gaps in teachers' instructional tasks performance which has been partly attributed to inadequate information concerning the performance of their tasks. This situation could have serious negative implications on curriculum delivery and has perhaps been responsible for the relatively low academic performance of students in the West African Senior School Certificate Examinations (WASSCE) in Nigeria public secondary schools. The effective means of updating teachers' skills and knowledge for improving instruction and learning is not well grounded thus making educational objectives seem not to be unattainable. Hence, the need for this study to investigate the extent to which staff development and working incentives influenced employee's productivity in public secondary schools in Oyo South Senatorial district, Oyo State, Nigeria.

Objectives of the Study

Major objective of this study is to investigate staff development and incentives as predictors of public secondary school teacher's productivity in Oyo South Senatorial district, Oyo State, Nigeria.

Specific objectives are to:

- (i) Assess the joint contribution of staff development (in-service-training, seminars, workshops, conferences and referral courses) on teacher's productivity in public secondary schools in Oyo South Senatorial district, Oyo State, Nigeria, and
- (ii) Examine the joint contribution of incentive strategies (salary increment, regular promotion, bonuses, awards and condition of service) on teacher's productivity in public secondary schools in Oyo South Senatorial district, Oyo State, Nigeria.

Hypotheses

H₀₁: There is no significant joint contribution of staff development (in-service-training, seminars, workshops, conferences and referral courses) on teacher's productivity in public secondary schools in Oyo South Senatorial district, Oyo State, Nigeria.

H₀₂: There is no significant joint contribution of incentive strategies (salary increment, regular promotion, bonuses, awards and condition of service) on teacher's productivity in public secondary schools in Oyo South Senatorial district, Oyo State, Nigeria.

Significance of the Study

This study is considered significant as its findings would create awareness on the significant influence of staff development and incentive strategies on teacher's job satisfaction and productivity in public secondary schools in Oyo South Senatorial district of Oyo State, Nigeria. Teachers are the hubs in which the education system rests upon and their roles cannot be underestimated if quality education is to be achieved. Findings of this study would be beneficial to them as it would enhance their job satisfaction and productivity when staff development such as in-service-training, seminars, workshops, conferences and refresher courses are organised for them and when incentive strategies such as salary increment, regular promotion, bonuses, awards and condition of service are improved upon.

The principal being the instructional leader is expected to be the driving force for effective curriculum delivery. Findings of this study would be beneficial to them as it would enable them to have better understanding of the need for periodic staff development activities for their teachers and application of incentive strategies that could enhance teachers' productivity towards enhanced students' academic performance. The findings would help the government to have a better understanding of how staff development and incentive strategies could enhance teachers' productivity and attainment of stated educational objectives. This would help them make proper decisions on what to do in making sure that effective strategies are put in place to ensure teachers' job satisfaction and enhance productivity. It is significant to students, parents and the entire society because when teachers are properly equipped with appropriate knowledge, skills and well-motivated, stated educational goals and objectives would be easily accomplished. The study would be of great help and point of reference to those who wish to carry out studies in this line of endeavour, and also fill the gap and contribute to knowledge on the subject area.

Methodology

Research Design: The descriptive survey research design was adopted for the study.

Population of the Study: According to Oyo State Teaching Service Commissions (2022), Oyo South senatorial district of Oyo State had Two Hundred and Ten (210) public secondary schools and five thousand, nine hundred and fifty-four (5,954) teachers.

Sample and Sampling Technique: Purposive and simple random sampling techniques were used to select Fifty (50) percent from all public secondary schools in Oyo South Senatorial district, Oyo State, making a total of one hundred and five (105) schools. It is purposive in the sense that all these schools must have been established and registered for at least ten years. Purposive and simple random sampling techniques were used to select Ten (10) teachers from all the one hundred and five (105) selected schools. It is purposive in the sense that all selected teacher had at least ten years cognate experience. The total number of respondents for the study is thus one thousand and fifty (1,050).

Research Instruments: The instrument used to collect data for the study was tagged "Teachers Productivity Questionnaire (TPQ)".

Validity of the Instrument: Copies of the instrument were given to experts in Measurement and Evaluation to assess its face and content validity. The items on the instrument were examined, scrutinized and vetted by these experts and necessary corrections on the instruments were made before data collection for the study.

Reliability of the Instrument: To determine the reliability of the instruments, a pilot study of the instrument was done using some schools and teachers which were excluded from the final study. The reliability of the instruments was then assessed using Cronbach's Alpha. The values of 0.82 was obtained, which was considered reliable enough.

Administration of Instrument: The instruments were administered personally by the researcher with the assistance of trained research assistants.

Method of Data Analysis: Retrieved instruments were analysed using multiple regression, at 5% level of significance ($P < 0.05$).

Results

H₀₁: There is no significant joint contribution of staff development (in-service-training, seminars, workshops, conferences and refresher courses) on teacher's productivity in public secondary schools in Oyo South Senatorial district, Oyo State, Nigeria.

Table 1: Joint Contribution of Staff Development on Teacher's Productivity in Public Secondary Schools in Oyo South Senatorial district, Oyo State, Nigeria

ANOVA						
Model	Sum of Squares	Df	Mean Square	F	P-Value	Decision
Regression	142.402	5	12.402	2.602	.005	Significant
Residual	1242.502	1204	10.625			
Total	1460.824	1316				

Model summary

R = .902

R Square = .824

Adjusted R Square = .702

Standard Error of the Estimate = 0.00062

Dependent Variable: Teacher's productivity

Predictors: (Constant), seminars, workshop, conferences and referral courses

F-value is significant at 0.05*

Table 1 shows a significant joint contribution of staff development (seminars, workshops, conferences and referral courses) on teacher's productivity in public secondary schools in Oyo South senatorial district, Oyo State, Nigeria ($F_{5, 1204}=2.602$, $P<0.05$). The results imply that staff development (seminars, workshops, conferences and refresher courses) jointly predicted teacher's productivity in public secondary schools in Oyo South senatorial district, Oyo State, Nigeria. The 'model summary' ($R = .902$; $R^2 = .824$; Adjusted $R^2 = .702$; Standard error of the estimate = .00062) shows that a high variation of 70.2% (adjusted $R^2 = .702$) in teachers' teacher's productivity can be explained by staff development (independent variables). The model summary also shows a very low standard error of .00062. Since the standard error of the estimates is very low, it therefore implies that the precision of the model was high.

H₀₂: There is no significant joint contribution of incentive strategies (salary increment, regular promotion, bonuses, awards and condition of service) on teacher's productivity in public secondary schools in Oyo South Senatorial district, Oyo State, Nigeria.

Table 2: Joint Contribution of Incentive Strategies on Teacher's Productivity in Public Secondary Schools in Oyo South Senatorial district, Oyo State, Nigeria

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	P-Value
Regression		204.832	4	22.473	2.614	.008
Residual		2684.352	624	6.842		
Total		2879.206	678			

Model summary
 R = .806
 R Square = .684
 Adjusted R Square = .658
 Standard Error of the Estimate = 0.00118

Dependent Variable: Teacher's Productivity

Predictors: (Constant), salary increment, regular promotion, job security and condition of service
*F-value is significant at 0.05**

Table 2 shows a significant joint contribution of incentive strategies (salary increment, regular promotion, job security and condition of service) on teacher's productivity in public secondary schools in Oyo South senatorial district, Oyo State, Nigeria ($F_{4, 624}=2.614$, $P<0.05$). The results imply that incentive strategies (salary increment, regular promotion, job security and condition of service) jointly predicted teacher's productivity in public secondary schools in Oyo South senatorial district, Oyo State, Nigeria. The 'model summary' ($R = .806$; $R^2 = .684$; Adjusted $R^2 = .658$; Standard error of the estimate = .00118) shows that a high variation (variability) of 65.8% (adjusted $R^2 = .658$) in teacher's productivity can be explained by incentive strategies (independent variables). The model summary also shows a very low standard error of .00118. Since the standard error of the estimates is very low, it therefore implies that the precision of the model was high.

Discussion of Findings

Findings from hypothesis one showed a high significant joint contribution of staff development (seminars, workshops, conferences and referral courses) on teacher's productivity in public secondary schools in Oyo South senatorial district, Oyo State, Nigeria. This finding corroborates that of Maclean (2018) whose study showed that staff development in general had positive impact on teachers' job performance in public senior secondary schools. Khan and Abdullah (2019) also found a positive and strong relationship between training and teachers' productivity. Paposa and Kumar (2019) results depicted a positive relationship between training and development practices and job satisfaction. It is also in line with Abazie (2020) study that showed a significant relationship between teachers' professional in-service training, workshop training, orientation and conference attendance and job performance in public secondary schools in Enugu State, Nigeria. Sharp-Akosubo and Amamilo (2020) findings also revealed that staff development in forms of in-service training, correspondence courses, conferences, workshops, distance learning or self-study, seminars, exhibitions were all significant on teachers' job satisfaction and productivity.

Umar (2017) findings also revealed significant influences of teachers' conferences and workshops on their job performance. Mduma and Mkulu (2021) findings revealed that training the workforce (teachers) had the most impact on various dimensions like improvement in teaching strategies,

effectiveness and personal, reduction in teachers' burnout, stress and turnover. Moreover, Chukwuemeka, Iremeka, Aneke, Ozioko, Muhammad, and Nweke (2021) study revealed that training and development enhanced teachers' job performance on the job and also significantly contributed to teacher retention among secondary schools in South East, Nigeria. Iwuagwu and Aiwuyo (2017) study showed that in-service training significantly influenced effective classroom control and teachers-students' relationship.

Findings from hypothesis two showed a significant joint contribution of incentive strategies (salary increment, regular promotion, bonuses, awards and condition of service) on teacher's productivity in public secondary schools in Oyo South Senatorial District, Oyo State. The findings are in accordance with that of Kassim and Onyango (2022) who found a strong correlation on the use of teacher performance incentives to boost their productivity. These relationships were found to be related to teachers' performance and increased effort as well as student learning outcomes. Adelekan (2020) finding also revealed a significant difference in teachers' incentives (condition of service and fringe benefits) and teachers' performance in school. This is a strong justification for rewarding teachers because of the complexity of the teaching profession, its relationship to student outcomes, and the substantial influence that student outcomes have on students' prospects for future development.

In support of this finding, Kassim and Onyango (2022) also reported that teachers who received incentives reported higher student performance than those who did not as it significantly motivated them to put more effort for improved students' academic achievement. It revealed that an effective rewards system motivated and propelled employees to better performance. Abubakar (2024) found that lack of fringe benefit for teachers led to demotivation and poor teacher responsiveness. The findings of this hypothesis are also in line with the findings by Oribobor (2021) which revealed a significant relationship between incentives and productivity. This is in line with the assertion made by Arnold (2013) that financial incentives are designed to get the maximum performance from the employees.

Conclusion

From the study, it was inferred that staff development and incentive strategies had strong positive impact on public secondary schools teacher's productivity in Oyo South senatorial district, Oyo State, Nigeria. The study not only provides empirical credence to the importance of staff development and incentive practices but also has implications for the management of educational institutions to conduct a proper training need analysis to ensure that appropriate training and development practices and effective incentive strategies are adopted leading to creating a productive learning environment in public secondary schools. This would eventually contribute to job satisfaction through appropriate skills development and motivation for teachers in public secondary schools for academic growth and development, and eventual accomplishment of educational goals and objectives.

Recommendations

Based on the findings of the study, the following recommendations were made:

Governments, philanthropists and other educational stakeholders should ensure that periodic in-service training programmes, seminars, referral courses, workshops and conferences are organised for all categories of teachers in Oyo South senatorial district of Oyo State, Nigeria to improve their capacity for effective utilisation of available resources towards enhanced productivity.

Governments, philanthropists and other educational stakeholders should assist teachers in Oyo South senatorial district of Oyo State, Nigeria to have access to monetary grants and sponsorship to embark on self-development educational programmes as this would promote job effectiveness

and productivity. This will eventually improve their job performance and for sustainable development as far as teaching and learning process is concerned.

Basic incentives in terms of reasonable rewards system, timely promotion and other welfare packages in form of house rent, car loans, and other forms of benefits should be given to teachers in Oyo South senatorial district of Oyo State, Nigeria periodically to boost their ego, make them to be more satisfied and committed to their job in order to be motivated for higher productivity.

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EXPLORING CULTURAL HERITAGE AS BASTION OF AFRICAN CREATIVITY AND INNOVATIONS IN THE DIGITALIZED ERA

¹Abiodun Akinola Oladiti (Ph.D), ²Isaac Oluwatoyin Ogundare,
³Mulikat Oluwatoyin Mustapha & ⁴Amos Olugbenga Ojebisi (Ph.D)

¹Department of Social Studies and Civic Education, Faculty of Social Science Education, Emmanuel Alayande University of Education, Oyo, Oyo State, Nigeria

² Department of Geography and Environmental Education, Faculty of Social Science Education, Emmanuel Alayande University of Education, Oyo, Oyo State, Nigeria

³Department of Linguistics and African Languages, Faculty of Arts, Emmanuel Alayande University of Education, Oyo, Oyo State, Nigeria

⁴Department of Curriculum and Instruction, School of Education, Federal College of Education (Special), Oyo, Oyo State, Nigeria
oladitiaa@eauedoyo.edu.ng

Abstract

The 21st century has witnessed a remarkable surge in African creativity and innovations driven by a renewed focus on cultural heritage as a foundation for contemporary advancements. This study explores the intersection of cultural heritage and African creativity and innovation beaming searchlight on how traditional knowledge systems, indigenous craftsmanship, and artistic expressions are being re-imagined in the digitalized era. Key areas such as fashion, architecture, digital arts, and technology are focused in this study with a view to highlighting how African cultural heritage can serve as a catalyst for sustainable and globally competitive innovations. The study revealed that: cultural heritage is a basis for preserving identity, fostering of economic empowerment, social cohesion, and technological advancements with African realities undertone as there is a strong positive relationship between cultural heritage and African creativity/innovation among youth and creative entrepreneurs in the 21st century; standardized beta values showed that indigenous knowledge, has a slightly stronger influence than digital technology; cultural heritage is wrought with challenges such as cultural appropriation, inadequate policy support, and the need for sustainable frameworks necessitating the need to harness Africa's rich cultural heritage through innovation to serve as driver of economic development, global recognition promotion, and sustainable indigenous knowledge systems. Policy reforms, increased investment in creative industries and the integration of cultural heritage in education and digital platforms becomes imperative.

Keywords: African creativity and innovation, Cultural heritage, Digitalized era, Indigenous knowledge; Sustainable development.

Introduction

The 21st century is characterized by unprecedented creativity and innovation across Africa marked by a conscious return to cultural roots and indigenous knowledge systems. Confirming this stance, UNESCO (2021) posits that as global development paradigms continue to shift toward inclusive and sustainable models, the value of Africa's rich and diverse cultural heritage has gained renewed attention as a critical driver of creative ingenuity and innovative enterprise. Thus, from traditional arts and crafts to indigenous technologies and philosophies, African societies are

reimagining their cultural legacies as vital assets for solving contemporary problems in education, technology, health, and enterprise.

African creativity are traditionally expressed through oral literature (Oladiti et al, 2024) as well as sculpture, textiles, music, architecture, and rituals serving aesthetic functions as well as socio-political and technological purposes. Today, these traditional forms are being re-interpreted through digital platforms, design thinking, and entrepreneurship, especially among African youth who are blending ancestral knowledge with global digital tools to create unique innovations with local relevance and global appeal (Adesanya et al, 2023). This interplay of tradition and modernity of course, represents a paradigm shift in the description and application of African creativity and innovation.

Cultural heritages manifesting in tangible and intangible forms (Ajibefun et al., 2024), keep gaining attention as an enabler of sustainable development. This perhaps informed the emphasis of African Union's Agenda 2063 on the need for cultural renaissance and indigenous knowledge integration to propel the continent toward socio-economic transformation (African Union, 2020). In the present dispensation, eco-design and creative entrepreneurs are tapping into traditional narratives and local materials that are both contextually relevant and globally competitive in promoting innovation across various sectors, including fashion, music and architecture (Onuoha, 2022). The rise of Afrobeat, Adire textile revival, and Afrofuturist art are indication of a cultural reawakening embedded in innovation in Nigeria the heart beat of Africa.

Presently, formal and non-formal education systems are now beginning to integrate cultural heritage into curricula, fostering identity development, creativity, and problem-solving skills among African youth (Ndlovu-Gatsheni, 2021). Digital technology, in particular, has enhanced the capacity to document, preserve, and disseminate cultural content, bridging generational knowledge gaps and inspiring novel ideas rooted in cultural authenticity (Tella et al, 2024). Nevertheless, challenges such as cultural commodification, inadequate policy support, and the digital divide continue to hinder full optimization of heritage-led innovation. Examining 21st-century African creativity and innovations through a cultural heritage lens is thus essential for understanding how indigenous values, digital transformation, and educational frameworks intersect to produce sustainable and identity-affirming innovation. This will ultimately translate to knowledge decolonization and impeccable reinforcement of the role of African culture in re-shaping a self-reliant and globally respected continent.

The Problem

In spite of Africa's unquantifiable reservoir of cultural heritage, the continent's contributions to global creativity and innovation have historically been undervalued or misrepresented in dominant development discourses. While indigenous knowledge systems, traditional arts, and cultural expressions have long demonstrated problem-solving capabilities and adaptive ingenuity, they are often excluded from mainstream innovation frameworks and education systems. This marginalization contributes to a persistent dependency on imported technologies and Western-centric innovation models, which may not align with local realities or cultural contexts. In recent years, however, there has been a noticeable resurgence of interest in leveraging cultural heritage for contemporary innovation across the continent.

From the global popularity of Afrobeat and Nollywood, to the rise of fashion rooted in traditional textiles like *Kente* and *Adire*, and the application of indigenous environmental practices in green architecture and climate action, Africa's creative industries and informal knowledge systems are becoming strategic assets for sustainable development. It is however disheartening that this potential remains largely untapped due to structural challenges such as weak cultural policies, lack

of investment in heritage-based innovation, limited digital access, and insufficient integration of indigenous knowledge in formal education and entrepreneurship programmes. The African youth that form the bulk of the population (regarded as ‘demographic dividends’) often grow up being disconnected from their cultural roots largely due to colonial legacies, globalization, and Westernized education models among others.

This disconnect invariably limits their ability to create contextually relevant innovations grounded in African identity and tradition. Without deliberate efforts to bridge traditional knowledge with 21st-century creativity and digital tools, the continent risks losing valuable cultural assets that could fuel original, sustainable, and inclusive innovation. Therefore, there is a compelling need to explore how cultural heritage and African creativity and innovation in the digitalized era can be better understood, developed, and supported which is the crux of this study.

Objectives of the Study

The following objectives are put forward to steer the study in the right direction. Thus, the study aims at:

- i. Examining the extent to which cultural heritage can influence African creativity and innovation among youth and creative entrepreneurs in the digitalized era;
- ii. To assess how the integration of indigenous knowledge and digital technology can foster culturally grounded and sustainable innovation in contemporary African societies.

In the light of the foregoing, this study is anchored on the following research question and hypothesis.

Research Question

To what extent does cultural heritage influence African creativity and innovation among youth and creative entrepreneurs in the digital transformation era?

Hypothesis

H₀: Cultural heritage has no significant influence on African creativity and innovation among youth and creative entrepreneurs in the digitalized era.

Cultural Heritage, a Catalyst for African Innovation

African cultural heritage encompassing oral traditions, indigenous technologies, symbolic systems, crafts, music, and traditional knowledge (Oladiti et al, 2024) serves as a vibrant foundation for creativity and innovation across the continent. Scholars such as Adeola et al. (2021) argued that the historical depth and communal orientation of African cultures provide unique frameworks for problem-solving, identity formation, and sustainable development. Traditional practices such as dyeing (*adire*), sculpture, storytelling, herbal medicine, and architecture have inspired contemporary art, fashion, wellness, and even biotechnology. These indigenous assets are not static; they evolve through reinterpretation, offering contextually relevant solutions rooted in ancestral wisdom (Nyamnjoh, 2017).

Cultural elements have also become central in branding and product development, especially among youth entrepreneurs who draw inspiration from language, symbols, and community values to shape locally grounded innovations (Nwauwa, 2020; Ajibefun et al, 2024). More so, studies have canvassed the integration of cultural heritage into modern innovation processes by advocating for the decolonization of knowledge systems and promotion of endogenous development models. For instance, Odora (2002) advanced that indigenous knowledge should not be seen as inferior to scientific paradigms, but rather as a complementary system with rich creative potential. Recent studies such as UNESCO (2022); Akinmolayan et al. (2023) also highlight how cultural heritage serves as a creative stimulus, especially when combined with digital technologies

and design thinking. As such, from the creative arts to agritech and education, innovation rooted in cultural identity fosters inclusivity, sustainability, and authenticity in African societies. Thus, African cultural heritage is not merely a relic of the past but a dynamic resource shaping the continent's innovative future.

Digital Transformation and the Rebirth of Indigenous Creativity

Digital transformation has significantly reshaped the landscape of indigenous creativity in Africa, providing new platforms for cultural expression, preservation, and innovation. Through the internet, mobile applications, virtual reality, and social media, indigenous art forms such as oral storytelling, traditional music, crafts, fashion, and folklore have found renewed life and global reach (Oladiti et al, 2024). Scholars have affirmed that digital tools are bridges between the traditional and the modern society (Mofoluwawo et al, 2025) which enables young African creators to reinterpret ancestral knowledge in ways that resonate with contemporary audiences (Bach et al, 2020; Adeeko, 2021). For instance, digital storytelling apps and AI-driven cultural content now incorporate African proverbs, idioms, and mythology, helping preserve languages and customs that were once at risk of extinction.

The creative industries in Nigeria, Ghana, and South Africa, especially in Nollywood, Afrobeats, and Afro-digital art, exemplify how digital media empower African innovators to re-imagined heritage for both local and international markets (UNESCO, 2022). In the same vein, digital transformation fosters collaborative innovation by connecting diverse knowledge systems and creative communities across borders. Platforms like YouTube, TikTok, and Instagram have enabled grassroots innovators to share indigenous practices globally while adapting them to modern tastes and commercial demands. It has been established that this convergence of tradition and technology is a "rebirth" of participatory, inclusive, and economically empowering indigenous creativity (Wunmi et al, 2023). As good and promising the foregoing sounds, it was the contention of Chiumbu (2019) that there is growing concerns about digital inequities, cultural appropriation, and the potential loss of authenticity when traditional content is commodified. The foregoing notwithstanding, ethically managed digital technologies are powerful tools for cultural sustainability and identity reinforcement in Africa's creative ecosystems.

Cultural Heritage and Contemporary Innovation - Challenges and Opportunities

Integrating African cultural heritage into contemporary innovation presents both immense opportunities and persistent challenges. For instance, heritage-based innovation offers a culturally grounded path to sustainable development by anchoring creative practices in local identity, community values, and ancestral knowledge on one hand (Adeola et al, 2021). When traditional crafts, symbols, and knowledge systems are incorporated into modern industries such as fashion, architecture, digital art, and alternative medicine, they generate products that are not only innovative but also culturally meaningful and socially inclusive (UNESCO, 2022). Additionally, cultural heritage can inspire entrepreneurial ventures, support rural revitalization, and enhance educational curricula by promoting decolonized, locally relevant content (Owusu-Mensah, 2021; Oladiti et al, 2025). In this way, the fusion of cultural memory with modern innovation frameworks has the potential to empower youth, preserve heritage, and foster global competitiveness.

However, several challenges do hinder the said integration such as the undervaluation of indigenous knowledge in formal innovation systems, lack of intellectual property protection for traditional knowledge, and limited institutional support for cultural entrepreneurship (Odora, 2002; Chisenga et al, 2023). Many innovators face systemic barriers such as inadequate funding, digital divides, and policy frameworks that favour Westernized definitions of innovation. Similarly, there is the risk of cultural appropriation and dilution when heritage is commercialized

without community consent or benefit-sharing. Some scholars also caution that the lack of structured documentation and transmission of indigenous knowledge poses a threat to its sustainability in the innovation ecosystem (Nwauwa, 2020). Addressing these barriers requires inclusive policy reform, ethical engagement with local communities, and deliberate efforts to embed cultural heritage in Africa's broader innovation and development agendas.

Cultural heritage and Culture-Based Innovation as Pathways to Sustainable Development

Culture-based innovation offers a transformative pathway to achieving sustainable development in Africa by aligning traditional knowledge with contemporary needs across economic, social, and environmental dimensions. Scholars assert that integrating cultural heritage into innovation systems enhances relevance, inclusivity, and resilience core principles of the Sustainable Development Goals (SDGs) (UNESCO, 2022; Adeyemi et al, 2020). For instance, using indigenous agricultural practices to improve food security, or applying traditional building techniques in eco-friendly architecture, demonstrates how local wisdom can address climate adaptation, poverty alleviation, and job creation simultaneously.

In like manner, cultural entrepreneurship rooted in local identity fosters social cohesion, community empowerment, and youth employment, especially in creative sectors like fashion, tourism, crafts, and performance arts (Akpan et al, 2021). These innovations not only preserve cultural values but also create scalable solutions that promote inclusive development. However, unlocking the full potential of culture-based innovation requires deliberate strategies and supportive ecosystems. Literature emphasizes the need for policy reforms that recognize cultural heritage as an innovation asset, integration of indigenous knowledge into formal education systems, and the promotion of digital platforms that amplify local creativity (Mawere, 2015; Ezeanya-Esiobu, 2019). Equally important is the provision of intellectual property rights, funding mechanisms, and mentorship opportunities tailored to indigenous innovators. When traditional knowledge is ethically integrated with modern science and technology, it fosters a circular model of development one that values sustainability over exploitation and community ownership over external dependency. Thus, culture-based innovation is not a nostalgic return to the past but a strategic reimagining of Africa's future rooted in heritage, dignity, and self-determination.

Material and Methods

This study adopts a mixed-method research design of quantitative approach to provide a comprehensive understanding of how cultural heritage influences African creativity and innovation in the digitalized era. The quantitative aspect involves the use of structured questionnaires that was administered to 120 purposively selected youth and creative entrepreneurs across selected regions in Nigeria that are known for cultural activities (e.g. Oyo, Lagos, Ibadan, and Abeokuta). Data collected through questionnaires were analysed using correlation and regression analysis to test the hypotheses.

Results and Discussion

Table 1: Pearson Product Moment Correlation result depicting Cultural Heritage and African Creativity/Innovation

Variables	N	Mean (X)	Mean (Y)	r-value	p-value	Decision
Cultural Heritage & African Creativity/Innovation	110	3.82	4.10	0.85	0.0001	Significant (Reject H_0)

Source: Author's Survey, 2025

The Pearson Product Moment Correlation analysis in Table 1 revealed a strong positive relationship ($r = 0.85$) between African cultural heritage and creativity/innovation among youth and creative entrepreneurs in the digitalized era. This means that individuals who are more engaged with or influenced by African cultural heritage tend to exhibit higher levels of creativity and innovation. The p-value of 0.0001 indicated that this correlation is statistically significant at the 0.05 level, implying that the observed relationship is unlikely to have occurred by chance. Therefore, the null hypothesis which stated that there is no significant relationship between African cultural heritage and creativity/innovation is rejected. This finding suggests that cultural values, traditional knowledge, oral histories, art forms, and indigenous practices continue to serve as important catalysts for contemporary innovation, especially when embraced and reinterpreted by young people and entrepreneurs. This study's finding aligns with the study of UNESCO (2023) emphasized that cultural heritage is a key driver of innovation in Africa, particularly when traditional knowledge is merged with youth creativity and digital tools. Similarly, the study of Adesina (2022) argued that African innovation is often rooted in cultural contexts, with entrepreneurs drawing on indigenous materials, oral traditions, and artistic expressions as sources of inspiration. Moreover, Ajayi and Olanrewaju (2023) found that cultural heritage such as the use of traditional symbols in fashion, architecture, and storytelling significantly contributes to product innovation and market differentiation among young African creatives. This validates the high correlation in your result and supports the assertion that cultural heritage is not a barrier to progress but rather a fertile ground for contemporary innovation. In the same context of digital transformation, the study of Ngugi et al. (2022) observed that youth who creatively digitize oral traditions, native languages, and indigenous design principles through social media and tech platforms demonstrate higher levels of entrepreneurial success and innovative impact.

Table 2:

Analysis of Regression coefficients of Indigenous knowledge and Digital Technology

Predictors	B (Unstandardized Coeff.)	Std. Error	Beta (Standardized)	t	Sig. (p-value)
(Constant)	1.12	0.21	—	5.33	0.00
Indigenous Knowledge (X_1)	0.45	0.08	0.51	5.63	0.00
Digital Technology Use (X_2)	0.29	0.07	0.38	4.14	0.00

Source: Author's computation, 2025

Table 2 on the regression analysis revealed that indigenous knowledge and digital technology are significant predictors of culturally grounded and sustainable innovation in contemporary African societies. The model had an R^2 value of 0.52, indicating that 52% of the variance in sustainable

innovation is explained by the integration of these two factors. This implies a strong contribution of culturally relevant inputs to modern innovation processes. The standardized beta values showed that indigenous knowledge ($\beta = 0.51$) has a slightly stronger influence than digital technology ($\beta = 0.38$). This finding aligns with recent studies that emphasize the central role of indigenous knowledge systems (IKS) in shaping context-specific innovation solutions. This study's findings supported the study of Adesina (2022) argues that Africa's innovation potential lies in its indigenous knowledge heritage, which offers sustainable blueprints for community-based development. Similarly, UNESCO (2023) emphasized that when digital technology is used to preserve, document, and disseminate traditional knowledge, it transforms cultural content into a driver of economic and technological progress. In East Africa, Ngugi et al. (2022) demonstrated how digital storytelling platforms have enhanced cultural transmission and entrepreneurial innovation among youth. They found that integrating indigenous values into mobile and online content (e.g., apps for herbal medicine or proverbs) drives both social impact and creative entrepreneurship. Also, the study of Ajayi et al. (2023) noted that Yoruba indigenous art and symbolism, when digitized and applied to fashion, architecture, and education, lead to culturally relevant and globally competitive products. This study's findings corroborated the study of World Bank (2022) who reported that combining indigenous knowledge with digital tools strengthens resilience, especially in agriculture, health, and climate adaptation sectors areas where local innovation is critical to sustainable development.

Concluding Remarks

The 21st century marks a critical era in which cultural heritage shapes African creativity and innovation. Far from being relics of the past, African indigenous knowledge systems, traditional practices, and cultural expressions have become foundational to new forms of entrepreneurship, design, education, and technology. As digital transformation and globalization accelerate, they offer both opportunities and challenges for integrating these cultural assets into contemporary innovation ecosystems.

Literature reveals that when cultural heritage is ethically and strategically integrated into modern creative practices, it fosters sustainable development, enhances identity, promotes social inclusion, and drives community-based economic growth. However, systemic barriers such as policy gaps, inadequate funding, and undervaluation of indigenous knowledge must be addressed to fully harness Africa's cultural wealth as a tool for innovation and development.

Arising from the findings from this study, the following recommendations are hereby put forward. It is imperative that African governments and development agencies formulate inclusive policies that recognizes and protect indigenous knowledge systems as valuable assets in national innovation strategies. This can be done through creation of legal frameworks for intellectual property rights, cultural entrepreneurship grants, and the inclusion of heritage-based innovation in national development plans.

Again, educational institutions and cultural organizations need to rise up to the integration of indigenous knowledge and creative heritage into formal curricula and digital platforms. Thus, empowering youth through culturally relevant education and digital tools is capable of launching African societies to innovation that is both globally competitive and locally grounded.

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PRE-SERVICE PRIMARY SCHOOL TEACHERS' ATTITUDE TO THE USE OF ARTIFICIAL INTELLIGENCE IN LEARNING IN EMMANUEL ALAYANDE UNIVERSITY OF EDUCATION, OYO, OYO STATE

¹Olumoroti Olaniyi Awolere (Ph.D) & ²Mary Adejoke Jesutoki (Ph.D)

^{1,&2}Department of Primary and Early Childhood Education
Emmanuel Alayande University of Education, Oyo
olumorotiawolere@gmail.com

Abstract

The study was designed to determine the pre-service primary school teachers' attitude to the use of artificial intelligence in learning. The study was a survey research design. Two research questions were raised and answered. A total of 100 pre-service primary school teachers were used as sample for the study. The instrument used for data collection was questionnaire titled 'Pre-service primary school teachers' attitude to the use of AI' (PPSTAUAI). Data collected were analysed using descriptive statistics of frequency count, percentages, mean, standard deviation and t-test. The result of the study revealed that pre-service primary school teachers have a favourable attitude towards the use of AI. It also revealed significant difference in the attitudes of male and female pre-service primary school teachers towards the usage of AI. Based on the findings, it was recommended that students should seize the chance to learn about the uses of AI technology in research and education. In addition, educators should become knowledgeable about AI-based educational interventions to successfully integrate them into their teaching practices.

Keywords: Pre-service, Primary, Attitude, Artificial Intelligence

Introduction

Artificial Intelligence (simply, AI) denotes the machines and computer systems that are capable of carrying out tasks that normally call for human intelligence. In order for computers to see, reason, learn and make decisions on their own, algorithms and models must be developed. According to Kengam (2020), artificial intelligence is one of the capabilities that humans have endowed computers with to carry out any work that humans are capable of. Artificial intelligence demonstrates the traits that we associate with human intelligence, such as behaviour, problem-solving, providing prompt solutions, and coming up with novel ideas to increase production. AI includes a number of subfields, including robotics, computer vision, natural language processing, and machine learning.

AI technologies can improve students' learning by giving real-time feedback, automate administrative processes, and deliver personalised learning experiences. Furthermore, AI aims to create intelligent systems that can mimic or simulate human cognitive capacities and better or automate human tasks, resulting in increased productivity and problem-solving skills across a range of fields (Cox and Tzoc 2023). It is deeply impacting all domains, including education.

According to Zawacki-Richter, Marín, Bond and Gouverneur (2019), the usage of AI-powered applications in education is growing popularity and attracted a lot of attention. According to Ouyang, Zheng and Jiao (2022), artificial intelligence (AI) in education facilitates better teaching and learning in both traditional classrooms and online higher education environments. According

to Zhang and Aslan (2021), artificial intelligence (AI) in education is an interdisciplinary field that crosses languages, computer science, learning sciences, psychology, and neuroscience.

Artificial intelligence is being used by many students to complete school assignments, such as essays and problem-solving, among other things. In education, artificial intelligence (AI) will not take the place of the current educational system, but it will give students better learning chances and support both teachers and students in a variety of ways, such as academic testing, assignment evaluation, and curriculum implementation. Shah (2023) stresses the potential of AI in changing educational methods further, arguing that it can enhance student motivation and engagement by personalising learning experiences by tailoring information to each student's needs. Westman et al. (2021) examine the role of AI in career guidance, identifying the potential for AI to support students in making informed decisions about their academic and professional paths. They argue that AI systems are capable of analysing enormous sizes of data to provide individualised career guidance based on each student's unique set of abilities, interests, and employment trends. According to Romina, Dana, Lavinia and Dan (2025), students are aware of the ethical issues raised by the growing usage of AI technologies, but they also see it as a useful tool for improving education and preparing them for their future employment. Developing individualised and productive learning environments that complement conventional education requires this strategy. AI has the potential to influence teaching, learning, and institutional management while bringing about long-lasting benefits throughout the educational system.

AI is widely acknowledged to have the ability to improve teaching and learning, solve many of the current issues in education, and educate the world's expanding population (Adiguzel, Kaya and Cansu, 2023). Innovative concepts and techniques are continuously incorporated, and it is upgraded with new tools. The majority of issues are resolved by AI using knowledge. AI tools enable personalised instruction that can be adjusted to the students' growing comprehension level (Sevara, 2023).

According to Baker and Smith (2019), there are three main ways that AI is influencing education: (a) learning, where AI helps with personalised learning through adaptive systems; (b) teaching, where automation lessens teachers' workloads by simplifying administrative, feedback, and assessment tasks; and (c) administration, where AI helps decision-makers by spotting research trends across institutions. Because of artificial intelligence, education is now more flexible than it was in the past (Pantelimon et al., 2021). AI combined with a number of cutting-edge technology allows the school to deliver individualised learning resources (Kumar, 2022). It gives each student comprehensive insight into their analytics-based performance. Learning Management Systems (LMS), chatbots, robots, virtual reality (VR), and other technologies can all benefit from artificial intelligence. In order to improve overall educational outcomes, there has been a trend in higher education to integrate modern technologies and practices. AI is being used more and more to improve learning, but students are worried about the ethical ramifications and how it will affect traditional learning environments. Research shows that students' willingness to use AI technologies is correlated with their knowledge, perceived ease of use, and social influences, emphasizing the need for more transparent communication about AI's benefits in education (Obenza et al., 2024).

Al-Chaer (2024) examines the wider effects of AI in higher education in light of the Arab world's digital transition. In particular, in areas where educational resources may be scarce, his work demonstrates how AI has the potential to improve learning experiences and increase access to education. According to Kumar (2018), AI has the potential to make teachers and students more dependable in the sphere of education, which could become problematic if equilibrium is not

preserved. Furthermore, having too much information on online platforms for classes causes chaos instead of a concentrated perspective.

By using artificial intelligence in the classroom, Pande, Sonawane, Jadhav and Mali (2023) assert that evaluating students' attitudes is crucial. An attitude is an assessment of a psychological object that is represented by dimensions like pleasant versus unpleasant and good versus bad. Pande, Sonawane, Jadhav and Mali (2023) define attitude as people's judgment about things, beliefs, and perspectives. Beliefs form the basis of an individual's attitudes towards technology, and impact their actions. As a result, a person's core beliefs shape their attitudes towards technology, which in turn shape their behaviour. Almaraz-López et al. (2023) investigated the attitudes of Spanish university students from the business management and education fields towards AI, and found that although students were aware of the importance of AI, their actual knowledge was limited, primarily due to insufficient training. Although many students have positive attitudes towards AI, their understanding of its educational benefits is often limited.

According to Tang, Chang and Hwong (2020), a negative attitude towards the educational adaption of artificial intelligence would lead to distraction and confusion over where and how to obtain knowledge for productive outcomes. In a similar vein, a study was carried out in Lebanon by Kharroubi et al. (2024) surveying university students to evaluate their knowledge, attitudes, and practices about artificial intelligence. The findings revealed that while just 43% of students showed high levels of understanding, 97.2% of students were familiar with AI. Though they varied by academic major, attitudes towards AI were generally positive, with students in technology-related fields exhibiting stronger acceptance. A study by Fabro et al. (2024) explores Filipino students' perceptions and use of Generative AI in academic writing through an online survey. Although attitudes regarding AI are neutral, there is a significant positive association between attitudes and AI use, according to the research.

Yadrovskaja et al. (2023) expressed a similar conclusion to the current research regarding the component of "overall attitude of learner towards AI" observed borderline high attitude, with a mean score of 46.35. According to this, there is room for much-needed improvement in raising awareness among school students. In the study of Yadrovskaja et al. (2023), the respondents have a positive attitude towards the use of AI despite not fully grasping the fundamentals of the technologies. Furthermore, because AI engages students and takes into account their different cognitive levels, some students think it will improve education (Kairu, 2020) and they are positive about its use (Obenza et al., 2023b; Pande et al., 2020). Kairu's (2020) study aims to evaluate students' perceptions of AI in a classroom context. The findings demonstrated that the AI technologies had a favourable impact on students' attitude.

According to a study by Eteng-Uket and Eteng (2024), the majority of students (98%) had a favourable opinion of AI-based educational interventions for research and learning. The results also indicated that students' attitudes were not significantly influenced by their gender. Moreover, it was found that pre-service teachers' attitudes toward AI in education reveals that there is no significant difference in attitudes toward the use of AI based on gender (Obateru, 2025). Also, Ayse, (2025) affirmed that female pre-service teachers demonstrated significantly more positive attitudes towards AI than their male counterparts. Merzifonluoglu and Gunes (2025) indicated that female pre-service teachers held more positive attitudes toward AI. According to Tien (2024), undergraduate Vietnamese students had a moderately positive attitude towards artificial intelligence. The results also showed no discernible difference in attitudes by gender, although there was a noticeable variance according to the student's university year.

Research on the effective use of AI to influence students' attitudes mostly focusses on students in secondary school and higher education. Analysis spanning gender and pre-service primary school teachers, however, is lacking and could offer important insights into influencing these perceptions. Including a larger range of students could broaden the focus and yield a more comprehensive insight of how university students' feel about artificial intelligence.

Research questions

1. What are the attitudes of pre-service primary school teachers to the use of AI?
2. Is there any significant difference between male and female pre-service primary school teachers' attitude to the use of AI?

Methodology

The study adopted a descriptive research design. The population consisted of pre-service primary school teachers in Emmanuel Alayande University of Education, Oyo. The sample for the study comprised one hundred (100) (consisting 48 males and 52 females) pre-service primary school teachers that were selected randomly through simple random sampling techniques. The instrument used is a questionnaire titled "Pre-service primary school teachers' attitude to the use of AI" ($\alpha = 0.71$). The questionnaire consisted of two sections. Section A measured the demographic characteristics of respondents. Section B consisted of 15 items which measured respondents' attitude to the use of AI. Data collected were analysed using descriptive statistics of frequency count, percentages, mean, standard deviation and t-test.

Result

Table 1: Mean responses of pre-service primary school teachers' attitude to the use of AI

S/N	ITEMS	SA%	A%	D%	SD%	Mean	SD
1.	AI is necessary for everyone.	19 (19.4)	68 (69.4)	7 (7.1)	4 (4.1)	3.04	0.66
2.	I like using AI apps	56 (57.1)	38 (38.8)	3 (3.1)	1 (1.0)	3.52	0.61
3.	AI helps me solve problems in real life.	14 (14.0)	70 (70.0)	15 (15.0)	1 (1.0)	2.97	0.58
4.	I need AI in my life in the future.	63(63.0)	20 (20.0)	12 (12.0)	5 (5.0)	3.41	.089
5.	AI is related to my daily life. ⁷	19 (19.0)	19 (19.0)	55 (55.0)	7 (7.0)	2.50	0.88
6.	AI classes are important.	26 (26.0)	117 (17.0)	53 (53.0)	4 (4.0)	2.65	0.91
7.	AI can makes people's lives more convenient	22 (21.0)	60 (60.0)	9 (9.0)	10 (10.0)	2.92	0.84
8.	It is interesting to use AI	17 (17.0)	67 (67.0)	5 (5.0)	11 (11.0)	2.90	0.81
9.	I will use AI to solve problems in daily life.	56 (56.0)	28 (28.0)	8 (8.0)	8 (8.0)	3.32	0.93
10.	It is worth to know AI very well	56 (57.7)	14 (14.4)	15 (15.5)	12(12.4)	3.18	1.10
11.	It is fun to learn about AI.	28 (28.0)	16 (16.0)	49 (49.0)	7 (7.0)	2.65	0.97
12.	I want to continue learning about AI	25 (25.0)	19 (19.0)	45 (45.0)	11 (11.0)	2.58	0.99
13.	I think every university student should learn about AI in university.	71 (71.0)	20 (20.0)	5 (5.0)	4 (4.0)	3.58	0.77
14.	I think that there should be more class time devoted to AI in university	11(11.2)	78 (79.6)	8 (8.2)	1 (1.0)	3.01	0.49
15.	I think that lessons about AI should be taught in university.	70 (70.0)	15 (15.0)	14 (14.0)	1 (1.0)	3.54	0.7
	Overall Mean					3.05	

Table 1 above revealed the responses of pre-service primary school teachers' attitude to the use of AI. The table shows clearly that pre-service primary school teachers' think every university student should learn about AI in university with the highest mean score of 3.58 where 70% of the students falls under the statement of "agree" of the Likert scale. The statement with the lowest mean belongs to statement 5 with a score of 2.50 that AI is related to pre-service primary school teachers' daily life. The overall mean score for pre-service primary school teachers' attitude to the use of AI is 3.05, translating to a descriptive interpretation of moderately positive.

Table 2: t-test showing the difference between male and female pre-service primary school teachers' attitude to the use of AI

Gender	N	$\bar{x}$	SD	T	P
Male	48	3.03	0.19	-1.18	0.24
Female	52	3.07	0.14		
Total	100				

Table 2 presents t-test statistics for the difference between male and female pre-service primary school teachers' attitude to the use of AI. It reveals that pre-service primary school teachers' mean score (3.03) is lower than that of females (3.07). The independent sample t-test presented in the table demonstrates that the difference is not statistically significant at 0.05 level.

Discussion of results

Research question 1 probes what the attitudes of pre-service primary school teachers are to the use of AI? The findings showed that pre-service primary school teachers have a favourable attitude towards the use of AI. These results support the findings of Yatrovskaia et al. (2023), who came to the conclusion that respondents had a favourable attitude towards the use of AI. It is also in agreement with the study of Pande et al., (2020) who affirmed that students have a good attitude toward using AI because it engages and accommodates their various cognitive levels. This study is consistent with one by Fabro et al. (2024), which uses an online survey to investigate how Filipino students see and utilise generative artificial intelligence in academic writing. A neutral attitude towards AI is found in the study, yet there is a significant positive association between attitude and AI use. It is also consistent with the findings of the study by Eteng-Uket and Eteng (2024), which indicated that the majority of students (98%) had a favourable opinion of AI-based educational interventions for research and learning. It is imperative that educators and policymakers address the potential and challenges posed by this revolutionary technology as AI continues to influence higher education.

The results in Table 2 showed that there was no significant difference in the attitudes of male and female pre-service primary school teachers towards the usage of AI. The results of Tien (2024), who confirmed that Vietnamese undergraduate students had somewhat positive sentiments about AI, are in line with our study. Additionally, the results showed no discernible gender-based differences in attitude. According to Eteng-Uket and Eteng's (2024) research, pupils' attitudes were not significantly impacted by their gender. In contrast to this study, Obenza et al.'s (2024) investigation explores if sex has an effect on college students' cognitive absorption and AI literacy. This study demonstrates that there is a difference and that sex may affect how college students use AI tools.

Conclusion

Pre-service primary school teachers' attitudes towards artificial intelligence use were investigated in this study. Several pre-service primary school teachers demonstrated a favourable attitude towards the use of artificial intelligence, according to the findings. The results also showed that there is no significant difference in the attitudes of male and female pre-service primary school teachers towards the usage of artificial intelligence.

Recommendations

Based on the findings of the study, the following recommendations are made:

- To improve overall AI literacy, educators should incorporate AI education into a greater variety of subject areas.
- It is imperative that protocols and moral guidelines for the application of AI in higher education be established.

- The inclusion of AI courses in university curricula should be encouraged by curriculum planners, who should highlight the importance of AI in higher education.
- Educators should become knowledgeable about AI-based educational interventions and their possible advantages in order to successfully integrate them into their teaching practices.
- Students should seize the chance to learn about the uses of AI technology in research and education.
- Policymakers and educators should be aware of the best ways to incorporate AI tools into the classroom so that they meet the needs of the workforce in the future and student expectations.
- Educational establishments need to find a balance between encouraging critical conversations about AI's ethical use and advancing AI literacy.
- Since schools are educational institutions, they ought to incorporate courses on artificial intelligence into their general curriculum.

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FROM CHALKBOARD TO CHATBOTS: REVOLUTIONISING THE FUTURE OF TEACHING IN THE UNIVERSITY THROUGH ARTIFICIAL INTELLIGENCE

¹Esther Omoniyi Mofoluwawo (Ph.D) & ²Rebecca Adenike Afolabi (Ph.D)

¹Department of Social Studies and Civic Education
Emmanuel Alayande University of Education

²Department of Educational Management
Emmanuel Alayande University of Education
mofoluwawoeo@eauedoyo.edu.ng

Abstract

This study explores the potential and challenges of AI adoption in Nigerian and African universities, focusing on its impact on teaching, learning, and administration. AI promises personalized learning and improved efficiency, addressing issues like large class sizes and limited resources. However, its integration faces hurdles such as poor infrastructure, digital inequality, policy gaps, and a lack of skilled personnel. Ethical concerns like data privacy and algorithmic bias also complicate deployment. Using a descriptive and exploratory design, including a SWOT analysis and literature review, the study analyzed secondary data and case studies. Findings indicate that while AI can personalize education and boost efficiency, its adoption is hampered by infrastructural and capacity limitations. The digital divide and absence of comprehensive policies worsen these challenges. Nevertheless, successful pilot programs highlight AI's potential with proper support. The study recommends strategic policy reforms, infrastructure investment, capacity building, and collaboration to ensure equitable and ethical AI integration in higher education.

Keywords: AI in Nigerian education, Chatbots, University teaching, Digital divide, Educational policy, Africa.

Introduction

Traditional teaching in Nigerian and African universities has long been teacher-centered, with lecturers as the primary knowledge source and students largely passive recipients. This often involves lectures in large classrooms with limited interaction, focusing on memorization rather than critical thinking (Aare Babalola, 2011; Uzoanya, Abraham & Nwogu, 2025). This approach reflects a colonial educational legacy and prioritizes uniformity over innovation. Beyond lectures, traditional methods heavily rely on textbooks with minimal practical learning, creating a gap between theory and real-world application and hindering the development of modern workforce skills (Uzoanya et al., 2025). Large class sizes and limited resources further impede the adoption of interactive pedagogies, often leading to student disengagement and lower academic achievement (Okoye & Eze, 2020).

Despite these challenges, traditional methods are deeply ingrained due to long-standing beliefs about the teacher's role and the value of formal education. Indigenous practices of oral knowledge transmission and apprenticeship were largely supplanted by Western-style formal education, leading to a rigid framework that often neglected local context and cultural relevance (Ezeani, 2023). However, recent discourse in Nigerian higher education acknowledges these limitations, hence the call for a shift towards innovative and hybrid teaching methods which incorporate both

technology and active learning. The COVID-19 pandemic has also accelerated interest in blending face-to-face instruction with digital tools to enhance accessibility and engagement (Okoye & Eze, 2020). These hybrid models aim to combine traditional strengths with modern technology's flexibility and interactivity, addressing systemic challenges in Nigerian and African universities (Uzoanya et al., 2025). This study explores the potential and challenges of AI adoption in Nigerian and African universities, focusing on its impact on teaching, learning, and administration.

Nigeria and many African countries face unique socio-economic challenges that significantly impact education and broader development. High unemployment rates, especially among youth, contribute to widespread poverty and social instability, which in turn affect students' ability to access and complete higher education (World Bank, 2025). The poverty rate in Nigeria, for example, is estimated at nearly 39%, with about 87 million people living below the poverty line, limiting many families' capacity to afford university tuition and related costs (World Bank, 2025). This socio-economic context creates a cycle where limited educational opportunities reinforce poverty and unemployment, posing a major barrier to educational advancement and innovation.

Infrastructural deficits further compound these socio-economic challenges. Nigeria's infrastructure, including electricity, transportation, and digital connectivity, remains inadequate and unreliable, which hinders effective teaching and learning in universities (NESG, 2025). Frequent power outages disrupt classroom activities and limit the use of technology-enhanced learning tools such as AI and chatbots. Poor road networks and transport systems also restrict students' and lecturers' mobility, especially in rural areas, while limited internet penetration and high data costs constrain access to online educational resources (AFSIC, 2025). These infrastructural shortcomings create an uneven educational landscape, with urban institutions better positioned to adopt innovative teaching methods than their rural counterparts do.

Cultural factors also play a critical role in shaping the educational environment in Nigeria and Africa. Traditional views on education often emphasize rote learning and respect for authority, which align with teacher-centered pedagogies prevalent in universities (Ezeani, 2023). Such cultural norms may slow the adoption of learner-centered and technology-driven approaches, as both students and educators may be hesitant to embrace new roles and interactive methods. Moreover, linguistic diversity and varying levels of English proficiency can affect the accessibility of AI tools and chatbots, which are often designed in dominant languages, potentially marginalizing some students (Ezeani, 2023). Cultural perceptions about technology and data privacy further influence acceptance and trust in AI applications within educational settings.

These socio-economic, infrastructural, and cultural challenges are intertwined with broader issues such as policy inconsistency, insecurity, and economic volatility. Nigeria's economic environment is marked by high inflation, limited foreign investment, and regulatory unpredictability, which undermine institutional capacity and funding for higher education innovation (The Conversation, 2025). Insecurity in various regions disrupts academic calendars and deters both students and staff. Together, these factors create a complex ecosystem where efforts to integrate AI and chatbots into university teaching must be carefully contextualized to address local realities and ensure equitable, sustainable educational transformation (NESG, 2025; World Bank, 2025). Against this backdrop, this research investigates the integration of AI and chatbot technologies can revolutionize the teaching, learning and administration in Nigerian universities. It will assess their impact on student knowledge construction and critical reasoning, examine their current availability and integration in teaching, learning, and administration, and identify key inhibiting factors to effective implementation, in Nigeria.

Literature Review

Traditional Pedagogy's Impact on Learning Experiences in Nigerian Universities

Traditional teaching methods predominantly follow a teacher-centered approach, where lecturers deliver content primarily through lectures, expecting students to listen, take notes, and memorize information. This lecture-based method is favored for its efficiency in transmitting large volumes of information to many students simultaneously, especially in resource-constrained Nigerian settings (Ajayi, 2022). However, this often limits student engagement, interaction, and critical thinking development, and emphasizes rote learning over active participation (Ajayi, 2022). This reliance on direct instruction creates a structured but passive learning environment, offering limited opportunities for independent exploration. This restricts accommodation of diverse learning styles and fails to promote self-directed learning crucial at the university level (Bakare, 2020). Consequently, students may struggle to apply theoretical knowledge practically, widening the gap between academic learning and workplace demands (Smith et al., 2018). While maintaining order and curriculum coverage, traditional methods often fall short in fostering collaboration, creativity, or critical analysis skills needed in today's dynamic job market (Ajayi, 2022).

The predominance of teacher-centered methods is also influenced by systemic factors such as large class sizes, inadequate facilities, and limited faculty training in pedagogical innovation (Bakare, 2020). Many lecturers lack formal training in educational methods, leading to overreliance on familiar lecture techniques rather than adopting interactive approaches. Policy gaps and insufficient implementation of adult learning principles further contribute to suboptimal learning outcomes (Bakare, 2020). Despite these challenges, there is growing recognition of the need to shift towards more innovative teaching methods. Problem-based learning, flipped classrooms, and blended learning are being explored to enhance student engagement, critical thinking, and practical skills, aiming to make learning more interactive, learner-centered, and aligned with the demands of the 21st-century knowledge economy (Ajayi, 2022).

Artificial Intelligence (AI) and Chatbots in Education

Artificial intelligence (AI) and chatbots are rapidly emerging as transformative educational tools in universities worldwide, including in Nigeria and Africa. AI refers to computer systems designed to perform tasks that typically require human intelligence, such as natural language processing, problem-solving, and personalized learning (World Bank, 2023). Chatbots, a prominent AI application, are conversational agents that interact with users through text or voice, providing instant responses and assistance. In the educational context, chatbots can support students by answering frequently asked questions, guiding learning activities, and offering personalized feedback, thereby enhancing accessibility and engagement (George, Udom & Jackson, 2024).

In Nigerian universities, AI-powered chatbots are increasingly being integrated to address the challenges of large class sizes, limited facility availability, and administrative bottlenecks. For instance, chatbots can handle routine student inquiries about course registration, schedules, and assessment deadlines, freeing academic staff to focus more on teaching and research (Igbokwe & Eze, 2024). Moreover, AI chatbots facilitate personalized learning by adapting content delivery to individual student needs, which is particularly valuable in contexts where face-to-face interaction is constrained by infrastructural limitations (World Bank, 2023). This innovation marks a significant shift from traditional, lecture-based methods towards more interactive, learner-centered education.

Research conducted in Nigerian universities has demonstrated the positive impact of AI chatbots on students' knowledge construction and critical reasoning skills. A mixed-methods study found that students using AI chatbots experienced improved engagement and deeper understanding of course materials, suggesting that chatbots can complement and enrich conventional teaching approaches (Ogunleye et al., 2023). Additionally, the adoption of AI chatbots aligns with the diffusion of innovation theory, indicating that factors such as compatibility with university goals, and perceived relative advantage influence students' acceptance and effective use of these technologies (George et al., 2024). This underscores the importance of institutional support and training in maximizing AI's educational benefits.

Despite these promising developments, challenges remain in fully leveraging AI and chatbots in Nigerian higher education. Issues such as inadequate internet infrastructure, unreliable power supply, limited funding, and concerns about data privacy hinder widespread implementation (Igbokwe & Eze, 2024). Nonetheless, ongoing initiatives to integrate AI tools into university systems reflect a growing recognition of their potential to revolutionize teaching and learning. By easing administrative burdens and providing personalized academic support, AI and chatbots represent crucial steps toward modernizing Nigerian and African universities and enhancing educational outcomes (World Bank, 2023; George et al., 2024).

Global AI in Education Literature

Globally, AI is recognized as a transformative force in education, with literature exploring its applications in teaching, learning, and administration. Globally, AI facilitates personalized learning, adaptive assessments, and intelligent tutoring systems that enhance student engagement and outcomes (Marques-Cobeta, 2024; Zawacki-Richter et al., 2024). However, the literature also highlights challenges such as digital divides, ethical concerns, and the need for robust policy frameworks to ensure equitable and effective AI integration. In African contexts, AI is viewed as a potential solution to longstanding educational challenges, including limited access, quality disparities, and teacher shortages, but infrastructural and socio-economic constraints remain significant barriers (Innovation Africa, 2024). This global perspective provides a foundation for understanding AI's role and potential in African and Nigerian education systems.

AI Adoption in Nigeria

In Nigeria, AI adoption in education is emerging but uneven, with pilot projects and research underscoring its potential to revolutionize instructional delivery and administrative efficiency (Ukala & Ukala, 2024). Nigerian studies emphasize AI's ability to personalize learning, provide real-time feedback, and support teacher functions, which could address challenges such as overcrowded classrooms and limited instructional resources (Makanjuola-Agbola & Idakwoji, 2024). Nevertheless, the practical use of AI remains constrained by outdated educational technologies and insufficient digital infrastructure, particularly in rural areas. Scholars advocate for integrating AI into curricula and teacher training programs to build capacity and foster acceptance among educators and learners (Ukala & Ukala, 2024; Makanjuola-Agbola & Idakwoji, 2024). This localized research highlights the need for strategic investments and policy support to scale AI adoption effectively.

Digital Infrastructure

Digital infrastructure is a critical concern, significantly influencing AI's deployment. Many Nigerian schools lack reliable internet, adequate computing devices, and stable electricity, limiting access to AI-driven tools (Makanjuola-Agbola & Idakwoji, 2024). The digital divide exacerbates inequities, underscoring calls for government-led infrastructure development and digital literacy initiatives (Ukala & Ukala, 2024). Across Africa, similar challenges persist, with successful AI

integration dependent on coordinated efforts to upgrade technology access and build digital competencies (Innovation Africa, 2024). Without addressing these foundational gaps, AI risks reinforcing existing educational inequalities.

Policy and Ethical Considerations

Policy and ethical considerations are pivotal. Nigerian literature stresses the urgency of developing comprehensive, culturally relevant policies that promote AI innovation while safeguarding data privacy, preventing algorithmic bias, and ensuring equitable access (Ukala & Ukala, 2024; International Policy Brief, 2024). Ethical frameworks must emphasize AI as a tool to augment, not replace, human educators. Across Africa, policy development is uneven, with calls for regional collaboration (Innovation Africa, 2024). Addressing ethical challenges through inclusive governance is essential to build trust and maximize AI's educational benefits sustainably.

AI adoption, digital infrastructure, policy frameworks, and ethical considerations

AI adoption in Nigerian and broader African education systems is increasingly viewed as a critical driver for transforming teaching, learning, and administrative processes. Nigeria's Federal Ministry of Education has embraced AI, launching initiatives like integrated platforms for tertiary education data management, e-learning tools (Inspire for Students, Ignite for Teachers), and the Nigeria Learning Passport (Federal Ministry of Education, 2025). Nationwide AI training programs for teachers aim to embed AI literacy (Nairametrics, 2025). Despite these advances, AI adoption remains uneven, favoring urban institutions (Makanjuola-Agbola & Idakwoji, 2025).

Digital infrastructure remains a significant barrier in Nigeria. Many schools, especially in rural areas, face unreliable electricity, limited internet, and insufficient computing devices (Makanjuola-Agbola & Idakwoji, 2025). The Nigerian government emphasizes investments in digital infrastructure alongside digital literacy programs to ensure equitable access (Federal Ministry of Education, 2025). Alternative learning pathways leveraging AI in underserved communities are also proposed to mitigate infrastructural deficits (Vanguard Nigeria, 2025).

Policy frameworks in Nigeria are evolving to support responsible AI adoption. The National Open University of Nigeria (NOUN) developed a policy guiding ethical AI use, emphasizing transparency, accountability, and data privacy (NOUN Quality Assurance, 2025). The Federal Ministry of Education's roadmap includes integrating AI literacy into curricula and fostering partnerships (Federal Ministry of Education, 2025). Experts advocate for deeper curriculum reforms to comprehensively embed AI, drawing lessons from countries with advanced AI education systems (Premium Times, 2025). However, policy implementation faces challenges related to coordination, funding, and capacity-building.

Ethical considerations are gaining prominence, focusing on fairness, bias mitigation, data security, and preserving human agency. While AI offers personalized learning and administrative efficiencies, concerns about algorithmic bias and equitable access persist given Nigeria's socio-economic disparities (Awarri, 2025). The government and educational institutions are urged to develop ethical frameworks ensuring AI tools augment rather than replace teachers (Federal Ministry of Education, 2025). Addressing these challenges requires inclusive stakeholder engagement, clear regulatory guidelines, and continuous monitoring.

Nigeria and ethical AI use in education systems

Nigeria is actively working to ensure ethical AI use in education through regulatory frameworks and institutional policies emphasizing fairness, transparency, and inclusivity. A key concern is mitigating algorithmic bias, which could perpetuate discrimination if AI tools do not reflect

Nigeria's cultural, linguistic, and socio-economic diversity (Awarri, 2025). The Nigerian government and private sector partners are called upon to create policies balancing AI adoption with data privacy, accountability, and protection of vulnerable groups (Awarri, 2025). At the institutional level, the National Open University of Nigeria (NOUN) has a formal policy guiding ethical AI adoption, prioritizing data privacy, transparency in algorithmic decision-making, and the well-being of learners and staff (NOUN Quality Assurance, 2025). Similarly, the University of Lagos (UNILAG) is developing a comprehensive AI ethics policy to curb academic misconduct and promote AI use for critical thinking (THISDAYLIVE, 2025). These initiatives reflect a growing recognition for ethical governance frameworks tailored to Nigeria's educational context.

Nigerian higher education experts have urged the Federal Government to enact comprehensive national legislation on AI, including clear objectives, implementation frameworks, and ethical guidelines. This call was restated during the inaugural AI Awareness Day in Higher Education, emphasizing the necessity of integrating ethical awareness alongside technical skills in AI education and policy development (Authority Nigeria, 2025). A national policy would provide a unified regulatory environment for consistent ethical standards and responsible AI use at scale. Ongoing collaborations between policymakers, educators, and technology practitioners aim to foster inclusive dialogue and capacity building around AI ethics. Organizations like Awarri partner with financial institutions and education stakeholders to promote fairness and accessibility in AI-driven learning technologies (Awarri, 2025). Workshops and training programs further support awareness and adherence to ethical principles (THISDAYLIVE, 2025). These efforts demonstrate Nigeria's multi-level approach to embedding ethical considerations in AI adoption within its education systems.

Capacity-Building Efforts, Curriculum Integration, and Faculty Competence Challenges

Capacity building remains a critical focus for Nigerian universities aiming to harness AI's potential. Several institutions have launched training programs and workshops to enhance faculty and student competencies in AI technologies. For example, the University of Abuja offers an Embedded AI Programme designed to equip students and staff with foundational AI skills relevant to industry and research (University of Abuja, 2025). Despite these efforts, many universities face challenges in integrating AI comprehensively into curricula due to limited expertise among faculty, inadequate teaching resources, and a lack of standardized AI education frameworks (Ejeh & Igbokwe, 2025). This skills gap hampers the effective incorporation of AI concepts across disciplines and restricts the ability to develop AI-driven pedagogical innovations.

Moreover, faculty competence challenges are compounded by infrastructural deficits and insufficient institutional support for continuous professional development. Many lecturers lack hands-on experience with AI tools, which affects their confidence and ability to incorporate AI into teaching and research effectively (Ejeh & Igbokwe, 2025). There is also a need for curriculum reforms that embed AI literacy and ethics systematically, preparing students for an AI-driven workforce. While some universities like Thomas Adewumi University have been recognized for their robust AI programs (TAU, 2025), widespread curriculum integration across Nigerian higher education institutions remains an ongoing challenge requiring coordinated policy and investment.

Government Policies and Initiatives Supporting AI in Education

The Nigerian government has introduced several policies and initiatives to promote AI adoption in education. The National Digital Economy Policy and Strategy (NDEPS) outlines a framework for leveraging digital technologies, including AI, to transform education and skills development nationwide (Federal Ministry of Communications, 2024). Complementing this, the National Information Technology Development Agency (NITDA) has launched a dedicated AI strategy

aimed at fostering AI research, capacity building, and ethical governance within Nigerian institutions, including universities (NITDA, 2025). These policies emphasize the importance of infrastructure development, curriculum innovation, and public-private partnerships to create an enabling environment for AI-driven education.

In the same vein, government-backed programs such as the Tertiary Education Trust Fund (TETFund) are partnering with agencies to boost AI studies by funding research, infrastructure, and faculty training in Nigerian universities (TETFund, 2025). The Ministry of Education has also initiated nationwide AI literacy campaigns and teacher training programs to build foundational AI skills at all educational levels (Federal Ministry of Education, 2025). While these policies and initiatives demonstrate strong governmental commitment, challenges remain in implementation, coordination, and ensuring equitable access to AI resources across diverse regions and institutions.

Challenges

Infrastructural Deficits: Internet Access and Power Supply

Infrastructural deficits remain a major challenge for AI adoption and digital learning in Nigerian education. Frequent power outages and unreliable electricity supply severely disrupt academic activities, limiting the consistent use of AI tools and online platforms (IIARD Journals, 2025). To address this, the federal government has initiated projects to ensure 24-hour power supply in select tertiary institutions through renewable mini-grid and solarisation projects, with universities like the University of Abuja already benefiting from stable electricity (This Day Live, 2025; Tribune Online, 2025). Alongside power improvements, efforts to deploy fibre optic internet connectivity to university hostels aim to provide high-speed, reliable internet access, which is critical for AI applications and digital learning (This Day Live, 2025; NAN News, 2025). However, these initiatives are currently limited to a few “special” institutions, and scaling such infrastructure nationwide, especially to rural and under-resourced universities, remains an ongoing challenge (This Day Live, 2025).

Despite government commitments, many Nigerian universities still struggle with inadequate broadband coverage and slow internet speeds, particularly outside urban centers (IIARD Journals, 2025). The digital infrastructure gap is exacerbated by limited maintenance of existing facilities and high costs associated with ICT tools and services, which strain institutional budgets (IIARD Journals, 2025). Without reliable power and internet, students and faculty face significant barriers to accessing AI-driven educational resources and participating in digital learning environments (Radio Nigeria, 2025). Addressing these infrastructural deficits requires sustained investment, public-private partnerships, and targeted policies to expand connectivity and energy stability across all educational institutions nationwide (This Day Live, 2025).

Digital Divide and Socio-Economic Inequalities

The digital divide in Nigeria’s education sector reflects broader socio-economic inequalities that limit equitable access to AI and digital learning tools. Urban universities and students generally enjoy better internet connectivity and power supply, while rural institutions and learners face severe infrastructural shortages, restricting their participation in AI-enhanced education (IIARD Journals, 2025). This divide risks exacerbating existing educational disparities, as students from lower-income backgrounds and remote areas may be excluded from the benefits of AI-driven personalized learning and digital resources (Radio Nigeria, 2025). Furthermore, the high cost of acquiring and maintaining ICT infrastructure disproportionately affects underfunded institutions, deepening inequities within the higher education system (IIARD Journals, 2025).

Socio-economic challenges also influence digital literacy and the capacity to utilize AI tools effectively. Students and educators in disadvantaged communities often lack access to devices and

training, compounding the digital gap (Radio Nigeria, 2025). Government initiatives like fibre-to-hostel projects and 24-hour power supply aim to reduce these disparities, but comprehensive strategies addressing affordability, digital skills, and inclusive infrastructure development are still needed (This Day Live, 2025). Without such measures, AI adoption risks reinforcing rather than alleviating Nigeria's educational inequalities.

Ethical Concerns: Data Privacy, Algorithmic Bias, and Cultural Acceptance

Ethical considerations are critical in deploying AI in Nigerian education, with data privacy emerging as a foremost concern. The collection and processing of student data by AI systems require robust safeguards to prevent misuse and protect learners' rights, especially given Nigeria's evolving regulatory environment on data protection (NITDA, 2025). Algorithmic bias is another pressing issue, as AI tools trained on non-local datasets may produce unfair or inaccurate outcomes that disadvantage Nigerian students or fail to reflect cultural contexts (Awarri, 2025). Ensuring AI systems are transparent, accountable, and culturally sensitive is essential to foster trust and acceptance among educators, students, and parents.

Cultural acceptance of AI in education also influences ethical deployment. Resistance may arise due to fears of job displacement among teachers or concerns about over-reliance on technology diminishing human interaction in learning (Awarri, 2025). Addressing these concerns requires inclusive dialogue, awareness campaigns, and ethical frameworks that emphasize AI as a supportive tool rather than a replacement for educators (NOUN Quality Assurance, 2025). Integrating local languages, values, and pedagogical traditions into AI design can further enhance cultural relevance and acceptance (Awarri, 2025).

Limitations in Faculty Training and Funding

Faculty training on AI technologies remains limited in Nigerian universities, constraining effective integration into teaching and research. Many academic staff lack practical experience and confidence in using AI tools, partly due to insufficient professional development programs and the absence of standardized AI curricula (IIARD Journals, 2025). This skills gap hinders the ability of educators to leverage AI for personalized instruction, data-driven decision-making, and innovative pedagogy. Moreover, limited institutional support and awareness further reduce faculty engagement with AI initiatives (IIARD Journals, 2025).

Funding constraints exacerbate these challenges, as universities often struggle to allocate resources for AI infrastructure, training, and research. The high costs of acquiring advanced hardware, software licenses, and maintaining digital facilities place significant financial burdens on institutions, especially those in lower-income regions (IIARD Journals, 2025). Although government programs like TETFund have pledged to address power and infrastructure deficits, sustained investment is needed to support comprehensive faculty capacity building and ensure equitable access to AI resources across Nigerian higher education (Tribune Online, 2025).

Conclusion

AI and chatbots offer transformative potential for Nigerian and African universities, enabling personalized learning, efficient academic support, and expanded educational access (Sule, 2024; Sharda University, 2025; SusAfrica, 2023). While studies in Nigerian universities show benefits for knowledge and critical reasoning when thoughtfully integrated (Obiwuru, 2024), ethical use and pedagogical guidance are paramount. However, realizing this potential is constrained by inadequate infrastructure (IIARD Journals, 2025; This Day Live, 2025), nascent policy frameworks (Federal Ministry of Communications, 2024; NITDA, 2025), and limited capacity building (Ejeh & Igbokwe, 2025; Sule, 2024). Harnessing AI's promise requires coordinated

multi-stakeholder efforts (Awarri, 2025; NOUN Quality Assurance, 2025; IIARD Journals, 2025; World Bank, 2024) to develop robust infrastructure, implement effective and ethical policies, and build essential competencies. This collaborative approach is crucial to ensure AI equitably enhances educational quality and access across the region.

Recommendations

Based on the stated objectives regarding AI-chatbot usage in Nigerian universities, particularly focusing on knowledge construction, integration levels, and inhibiting factors in the South-South geopolitical zone, the following three suggestions are proposed:

- **Implement Comprehensive Orientation and Ethical Training for Students and Faculty**
To maximize the positive impact of AI-chatbots on knowledge construction and critical reasoning, universities should develop structured orientation programs that educate students and faculty on the ethical and effective use of AI-chatbots. This includes training on how to critically evaluate AI-generated information, avoid over-reliance, and maintain active engagement in the learning process to prevent passive learning and academic dishonesty (Obiwuru, 2024). Embedding critical thinking education alongside AI usage will help preserve the constructivist learning process and enhance cognitive skills.
- **Increase Investment in AI-Chatbot Infrastructure and Integration Across Faculties**
Universities, should prioritize expanding the availability and integration of AI-chatbot technologies within teaching, learning, and administrative functions. This requires targeted funding to acquire AI tools tailored to specific academic disciplines and administrative needs, as well as technical support for seamless integration into existing learning management systems (Academia.edu, 2023). Pilot projects like the AI-Integration Pilot Project (AIPP) at University of Nigeria Nsukka demonstrate the viability of such initiatives and should be scaled regionally.
- **Address Inhibiting Factors Through Policy and Stakeholder Engagement**
Key barriers such as limited digital literacy, infrastructural deficits, and resistance to AI adoption must be addressed through inclusive policy frameworks and stakeholder engagement. Universities should collaborate with government bodies, technology providers, and educators to develop policies that support AI infrastructure development, faculty training, and awareness campaigns that highlight AI's benefits and ethical considerations.

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INTEGRATING ARTIFICIAL INTELLIGENCE IN BUSINESS EDUCATION FOR SUSTAINABLE DEVELOPMENT: EMPIRICAL EVIDENCE FROM PUBLIC UNIVERSITIES IN SOUTHWEST NIGERIA

¹Solomon Oyelami, Oyewole (Ph.D), ²Dr. Ayinde Dauda, Oladeji,
³Mrs. Risikat Mojisola Folorunso, ⁴Oladele Nathaniel Olaniyi, &
⁵Ibitoye Olayinka (Ph.D)

^{1,2&3}Department of Business and Entrepreneurship Education,
Faculty of Vocational, Innovation and Engineering Education,
Emmanuel Alayande University of Education, Oyo, Nigeria

⁴Department of Vocational and Technical Education,
Faculty of Education, Ekiti State University, Ekiti, Nigeria

⁵Business Education Department,
Federal College of Education (Special), Oyo, Nigeria

Abstract

This study investigated the integration of Artificial Intelligence (AI) in Business Education for sustainable development in public universities in Southwest Nigeria. The study investigated the role of artificial intelligence (AI) in enhancing Business Education for sustainable development in Southwest Nigeria. With the global acceleration of AI adoption in education, this study evaluates the extent to which AI tools are integrated into Business Education instruction and administration, and how such integration supports the attainment of Sustainable Development Goals (SDGs), particularly in the areas of quality education, employment, and innovation. A descriptive survey design was employed with a population of 300 Business Educators drawn from state and federal universities in the region. A structured questionnaire titled "Artificial Intelligence Integration in Business Education for Sustainable Development Questionnaire (AIIBESDQ), was developed. The instrument underwent face and content validation by experts in Business Education and Educational Technology. A pilot study conducted in one institution outside the study population yielded a reliability coefficient of 0.87 using the Cronbach Alpha method, indicating high internal consistency, was used for data collection. The data collected were analysed using mean and standard deviation to answer five research questions. Findings revealed moderate awareness but low frequency of AI use, despite strong agreement on its benefits for teaching effectiveness, personalized learning, and curriculum relevance. Significant challenges identified include lack of training, inadequate infrastructure and absence of AI policy frameworks. The study concludes that AI integration in business education is crucial for achieving Sustainable Development Goals (SDGs). The study recommends the provision of AI training programmes for lecturers, policy formulation on AI inclusion in curricula and collaborative partnerships with Educational Technology firms and international donors to strengthen capacity i.e. strategic investments in training, infrastructure, and policy development. These steps are crucial to reposition Business Education as a driver of innovation and sustainable workforce development in Africa.

Keywords: Integrating, Artificial Intelligence, Business Education, Sustainable Development and Empirical Evidence

Introduction

The emergence of Artificial Intelligence (AI) is fundamentally reshaping global educational systems, with business education standing at the crossroads of digital innovation and sustainable economic development. As the world navigates the complexities of the Fourth Industrial Revolution (4IR), education systems—particularly in Africa—are under increasing pressure to equip learners with the competencies needed for a knowledge-driven, digital economy (Adeleke & Onibon, 2022). Business education, with its orientation toward entrepreneurship, commerce, technology and management, plays a pivotal role in workforce preparation. However, the traditional modes of delivery and curriculum design are no longer adequate to meet the challenges posed by digital transformation and sustainability imperatives (Okoli & Ezegebe, 2021). The 21st-century business environment is increasingly driven by digital innovation, and Artificial Intelligence (AI) is at the forefront of this transformation. Globally, educational systems are adopting AI to improve efficiency, personalise learning, and prepare graduates for technologically advanced work environments (Zawacki-Richter et al., 2019). In Nigeria, where unemployment and curriculum-labour market mismatch persist, the integration of AI into Business Education presents a promising pathway for bridging skill gaps and achieving the Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 8 (Decent Work and Economic Growth).

Artificial Intelligence, as a subset of emerging technologies, offers powerful tools for transforming teaching, learning, assessment and administrative processes. These include intelligent tutoring systems, AI-driven analytics, automated assessment, adaptive learning platforms and virtual assistants (UNESCO, 2021). In business education contexts, AI can simulate real-world business environments, automate routine accounting tasks, enhance data-driven decision-making training and foster personalised learning experiences (Zawacki-Richter et al., 2019). Yet, its application in many African tertiary institutions remains limited due to infrastructural constraints, faculty capacity, policy vacuum and digital illiteracy (Adu & Olatunji, 2023). Business education, as a vocational and professional program, is expected to equip learners with practical skills in accounting, entrepreneurship, management, and information systems. However, the advent of AI has shifted the educational focus toward digital competencies, data literacy, and automation. According to UNESCO (2021), integrating AI into education can transform traditional pedagogy into a smart learning ecosystem that supports personalised and inclusive education. Yet, the Nigerian context remains underexplored in terms of readiness, usage and strategic integration of AI into business education (Salawu & Oduwaiye, 2024).

While ICT use in Nigerian universities has gained momentum, most studies focus on generic e-learning platforms rather than AI-specific applications like intelligent tutoring systems, predictive analytics and machine learning in instructional design (Adu & Olatunji, 2023). Moreover, despite AI's potential to reshape business curricula and promote sustainable entrepreneurship, empirical data on its actual implementation in Nigeria's business education sector is scarce. Okoli and Ezegebe (2021) observed that even where AI awareness exists, adoption is hampered by lack of training, infrastructure and institutional policy support. The Southwest region of Nigeria, home many of the country's leading universities, provides an ideal setting for examining AI integration. With relatively better infrastructure and high student enrolment in business-related programs, the region holds significant potential for pioneering AI-based business education.

The Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation and Infrastructure), demand that educational institutions adopt transformative technologies to drive inclusive and equitable learning opportunities. AI integration aligns with these objectives by bridging learning

gaps, enhancing digital competencies, and preparing learners for AI-driven industries (World Bank, 2022). Unfortunately, the level of AI integration in business education in Nigeria remains largely anecdotal, lacking empirical support and institutional coordination.

This study, therefore, explores how AI is being adopted in the business education programs of Nigerian universities, particularly in the Southwest region, and its implications for sustainable development. It aims to evaluate the current practices, challenges, and strategic opportunities available to reposition business education through AI. The choice of Southwest Nigeria is informed by its relatively high concentration of public universities, ICT penetration and progressive educational policies.

Statement of the Problem

Globally, AI is reshaping instructional design, content delivery, assessment, and student support services through tools such as intelligent tutoring systems, chatbots, automated grading, and predictive analytics (Zawacki-Richter et al., 2019). Despite these trends, there is limited empirical evidence on how Nigerian universities, particularly in the Southwest, are integrating AI into business education programs to foster sustainable development.

While a few Nigerian institutions have initiated e-learning platforms and digital resource centres, these efforts often lack deliberate strategies for AI inclusion, structured implementation, and capacity-building programs for lecturers (Okoli & Ezegbe, 2021). Moreover, many business educators are not adequately trained in using AI tools, resulting in a slow adoption rate and a disconnect between educational content and the demands of AI-driven labour markets (Ogunlade & Alabi, 2022). There is also the challenge of insufficient infrastructure, limited funding, and the absence of national policy directives to guide AI integration in higher education (UNESCO, 2021; World Bank, 2022).

Previous studies have generally focused on ICT usage, digital literacy, and online learning in business education (Adeleke & Onibon, 2022), but few have examined the extent, pattern, and strategic importance of AI application specifically in business education as a tool for achieving sustainable development goals in Nigeria. Furthermore, no significant study has empirically investigated business educators' awareness, readiness, and use of AI within public universities in Southwest Nigeria, despite the region being one of the most educationally advanced in the country.

This study, therefore, fill this critical gap by empirically examining the integration of AI in business education programs across state and federal universities in Southwest Nigeria. It explored the current practices, challenges, and opportunities for repositioning business education as a transformative force for sustainable workforce development in an AI-driven economy.

Purpose of the study

The major reason for this study is to ascertain the integration of artificial intelligence in business education for sustainable development as empirical evidence from public universities in Southwest Nigeria. Specifically, to:

1. Investigate the extent to which Business Educators in public universities in Southwest Nigeria aware of artificial intelligence applications in education?
2. Determine how frequently Business Educators use AI tools in teaching, assessment, and administration?
3. Find out the perceived benefits of integrating AI into business education for sustainable development?

3. Ascertain the challenges Business Educators face in adopting AI in their instructional delivery?
4. Determine strategies that can be employed to enhance AI integration into business education programs in Nigerian universities?

Research Questions

The study is guided by the following research questions:

1. To what extent are Business Educators in public universities in Southwest Nigeria aware of artificial intelligence applications in education?
2. How frequently do Business Educators use AI tools in teaching, assessment, and administration?
3. What are the perceived benefits of integrating AI into business education for sustainable development?
4. What challenges do Business Educators face in adopting AI in their instructional delivery?
5. What strategies can be employed to enhance AI integration into business education programs in Nigerian universities?

Empirical Underpinning

The rapid expansion of artificial intelligence (AI) in education has inspired multiple empirical investigations across Africa and globally. However, while many of these studies have explored general educational technology or ICT usage, focused research on AI within Business Education especially as it relates to sustainable development outcomes-remains limited. For instance, Adu and Olatunji (2023) conducted a national survey examining the readiness of Nigerian university lecturers to adopt AI. Their findings revealed significant gaps in technical training, access to AI tools, and supportive institutional policies. However, the study was general across disciplines and did not isolate business education-specific contexts or implications. Similarly, Ogunlade and Alabi (2022) explored the influence of digital teaching competence on AI awareness in South-West Nigerian universities. Although their work pointed to a positive correlation between digital literacy and AI readiness, it stopped short of connecting these competencies to the Sustainable Development Goals (SDGs) or exploring business education as a unique sub-sector with potential for workforce transformation. Zawacki-Richter et al. (2019) conducted a global systematic review of AI applications in higher education and highlighted the dominance of research in STEM and computer science fields. They reported a glaring neglect of AI in vocational and business education streams, reinforcing the need for disciplinary-specific investigations. Likewise, Okoli and Ezegebe (2021) reported low integration of AI tools in accounting and business communication courses in Nigerian polytechnics, citing lack of funding, curriculum rigidity and limited AI exposure among lecturers.

In contrast, Salawu and Oduwaiye (2024) proposed a policy framework for mainstreaming AI in Nigerian higher education but acknowledged that empirical data from field-level implementation is scarce, especially from regions like Southwest Nigeria, where infrastructural potential exists but is underutilised. Despite these contributions, none of the reviewed studies have empirically examined the combined themes of AI usage, business educator readiness, instructional challenges, and sustainability outcomes within the same framework, particularly in the context of Southwest Nigeria's public universities.

Method

This study adopted a descriptive survey design, which is appropriate for obtaining detailed information on current practices, perceptions, and challenges related to the integration of Artificial Intelligence (AI) in Business Education. The design allowed for the collection of data from a

representative population to describe the current situation without manipulating variables. The population of the study comprised 300 Business Educators drawn from selected state and federal universities in Southwest Nigeria, including institutions in Oyo, Ogun, Osun, Ondo, Lagos, and Ekiti States. These universities were chosen due to their high concentration of business education programmes and relative exposure to educational technology. A stratified random sampling technique was employed to ensure representation across both state and federal institutions. From the total population, a sample of 180 educators was drawn proportionally, including senior lecturers, lecturers 1 and 11, assistant lecturers, and academic technologists involved in business education instruction. The instrument for data collection was a structured questionnaire titled "*Artificial Intelligence Integration in Business Education for Sustainable Development Questionnaire (AIIBESDQ)*". Items were measured on a 4-point Likert scale ranging from *Strongly Agree* (4) to *Strongly Disagree* (1). To ensure content and face validity, the drafted instrument was reviewed by three experts—one in Business Education, one in Educational Technology, and one in Measurement and Evaluation. Their suggestions informed the final structure and wording of items. For reliability, the instrument was pilot-tested on 20 Business Educators in a university outside the study area. The Cronbach Alpha method was used to determine internal consistency, and the overall reliability coefficient was 0.87, indicating a high level of reliability. The questionnaire was administered both physically and electronically using Google Forms. Participants were briefed on the purpose of the study, and informed consent was obtained. Respondents were assured of anonymity and confidentiality. Data collected were analysed using descriptive statistics, specifically mean and standard deviation, to answer the research questions. Mean values were interpreted using the decision rule: 3.50 – 4.00 is Strongly Agree, 2.50 – 3.49 is Agree, 1.50 – 2.49 is Disagree and 1.00 – 1.49 is Strongly Disagree.

Results

Research Question one: To what extent are Business Educators aware of artificial intelligence applications in education?

Table 1: Mean and standard deviation of responses on awareness of AI applications among Business Educators (N = 180)

S/N	AI Awareness Item	Mean	SD	Decision
1.	I understand what artificial intelligence means.	3.62	0.54	Strongly Agree
2.	I am aware of AI tools such as ChatGPT, Grammarly, etc.	3.48	0.61	Agree
3.	I am aware of AI use in student assessment and grading.	3.29	0.72	Agree
4.	I can distinguish between AI and traditional ICT tools.	2.89	0.78	Agree
	Weighted Average	3.32	0.66	Agree

The overall mean scores show that business educators have moderate to high awareness of AI tools ($\bar{X} = 3.32$). This supports findings by Adu and Olatunji (2023), who noted rising awareness but limited training in AI integration across Nigerian universities.

Research Question Two: How frequently do Business Educators use AI tools in teaching, assessment, and administration?

Table 2: Frequency of AI Usage by Business Educators

S/N	AI Usage Item	Mean	SD	Decision
1	I use AI tools in lesson preparation (e.g., generating content).	2.72	0.81	Agree
2	I use AI-based platforms in teaching and learning.	2.45	0.76	Disagree
3	I use AI for grading and feedback automation.	2.33	0.80	Disagree
4	I use AI for administrative tasks (e.g., scheduling, emails).	2.61	0.84	Agree
	Weighted Average	2.53	0.80	Agree

Mean scores reveal infrequent use of AI in teaching and assessment despite moderate awareness. These findings align with Ogunlade and Alabi (2022), who noted a gap between digital competence and actual AI application in Nigerian academia.

Research Question 3: What are the perceived benefits of integrating AI into business education for sustainable development?

Table 3: Perceived Benefits of AI in Business Education

S/N	Benefit Item	Mean	SD	Decision
				Strongly
1	AI improves teaching effectiveness.	3.60	0.51	Agree
2	AI enhances personalized learning and feedback.	3.48	0.60	Agree
				Strongly
3	AI promotes digital literacy and future readiness.	3.55	0.52	Agree
4	AI helps align business education with SDGs.	3.40	0.59	Agree
	Weighted Average	3.51	0.56	Agree

Respondents strongly agree that AI offers numerous benefits, especially in terms of pedagogical innovation, personalized learning, and graduate employability. This reinforces the assertions by Zawacki-Richter et al. (2019) and World Bank (2022) that AI plays a transformative role in education for sustainable workforce development.

Research Question 4: What challenges do Business Educators face in adopting AI in their instructional delivery?

Table 4: Challenges of AI Adoption

S/N	Challenge Item	Mean	SD	Decision
				Strongly
1	Lack of AI training for lecturers.	3.71	0.48	Agree
				Strongly
2	Inadequate infrastructure (internet, electricity, hardware).	3.64	0.55	Agree
				Strongly
3	Absence of institutional policy on AI adoption.	3.58	0.57	Agree
4	Resistance to change from traditional methods.	3.12	0.65	Agree
	Weighted Average	3.51	0.56	Agree

Key challenges include poor infrastructure, lack of capacity building, and absence of AI-specific policies, echoing concerns raised by UNESCO (2021) and Salawu and Oduwaiye (2024). These barriers hinder the full adoption of AI in Nigerian business education.

Research Question 5: What strategies can be employed to enhance AI integration into business education?

Table 5: Suggested Strategies for AI Integration

S/N	Suggested Strategy	Mean	SD	Decision
1	Organizing regular AI training/workshops for educators.	3.72	0.47	Strongly Agree
2	Government funding and infrastructure investment.	3.69	0.50	Strongly Agree
3	Integrating AI into business education curriculum.	3.60	0.51	Agree
4	Establishing institutional partnerships with tech companies.	3.55	0.54	Strongly Agree
	Weighted Average	3.64	0.51	Agree

Respondents agree that effective AI integration requires multistakeholder efforts, including policy reform, capacity building, and partnerships with EdTech firms, in line with recommendations from World Bank (2022) and Okoli & Ezegbe (2021).

Graphical Illustrations

fig. 1: Usage of Digital Tools among Business Educators

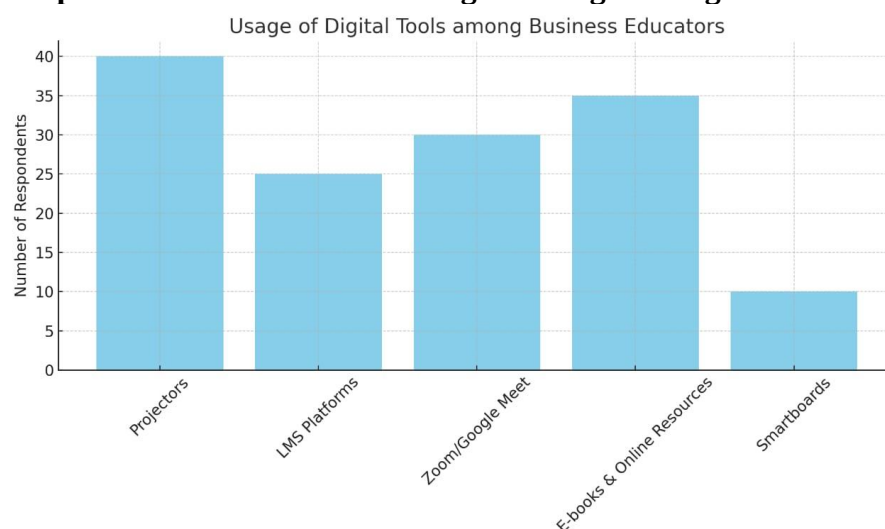
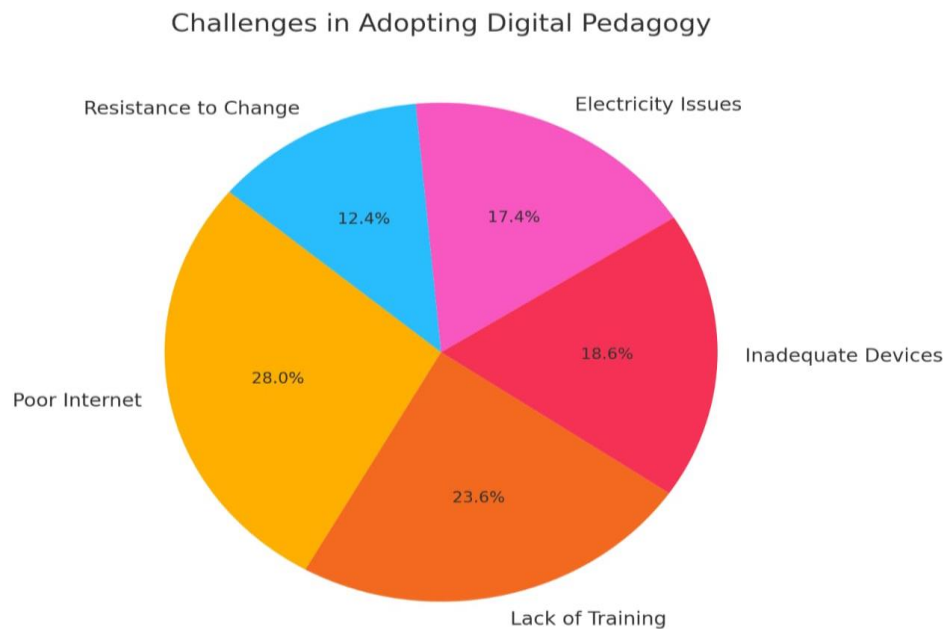


Fig. 2 Challenges in Adopting Digital Pedagogy



Discussion of Findings

The findings from this study provide significant insights into the awareness, usage, benefits, challenges, and strategic implications of integrating Artificial Intelligence (AI) in Business Education within public universities in Southwest Nigeria. Each research question is discussed in relation to the empirical results and supported by recent scholarly works. From Table 1, the respondents demonstrated moderate to high awareness of AI applications such as ChatGPT, Grammarly, and intelligent assessment systems ($\bar{X} = 3.32$). This aligns with the findings of Adu and Olatunji (2023), who reported increasing awareness of AI tools among Nigerian lecturers due to social media exposure and academic discourse, though actual classroom application remains low. Similarly, Ogunlade and Alabi (2022) emphasised that awareness is a necessary first step in the AI adoption curve, as conceptual understanding influences willingness to engage with AI-driven instruction.

From Table 2, the mean scores show limited practical usage of AI tools in instructional delivery ($\bar{X} = 2.52$), especially for assessment and teaching activities. This result supports the observation by Okoli and Ezegebe (2021) that although educators may know about AI, a large gap remains between knowledge and pedagogical application due to factors such as fear of technology, lack of time for training, and infrastructural constraints. The World Bank (2022) further noted that institutions across Africa often fail to move from awareness to adoption because of inadequate policy frameworks and lack of localised AI infrastructure.

According to Table 3, business educators agreed that AI can enhance personalised learning, promote digital literacy, and improve curriculum alignment with industry needs ($\bar{X} = 3.51$). These findings resonate with those of Zawacki-Richter et al. (2019), who observed that AI provides scalable, adaptive learning environments and fosters self-paced learning critical for vocational and business disciplines. Additionally, UNESCO (2021) emphasised AI's potential to help achieve SDG 4 (quality education) and SDG 8 (decent work), especially in developing countries seeking digital inclusion.

As reflected in Table 4, key constraints include lack of AI-specific training ($\bar{X} = 3.71$), inadequate infrastructure ($\bar{X} = 3.64$), and weak institutional policies ($\bar{X} = 3.58$). These challenges reflect national trends, as Salawu and Oduwaiye (2024) identified the absence of a national digital policy that defines AI expectations for educators in Nigeria. Infrastructure and training were also flagged by Adu and Olatunji (2023) as critical impediments, particularly in state-owned institutions with fewer resources.

Table 5 reveals high agreement on the importance of strategic interventions such as training, curriculum reform, funding and partnerships ($\bar{X} = 3.64$). These strategies echo recommendations by the World Bank (2022) and UNESCO (2021), which advocate for multi-stakeholder involvement in developing scalable AI integration models, particularly in Africa's tertiary institutions. The push for collaboration with EdTech firms also supports Okoli and Ezegebe's (2021) proposition that partnerships can bridge gaps in expertise and resource availability.

Synthesis and Implications. The discussion confirms that Business Educators are open to AI innovations but are hindered by systemic barriers, including poor infrastructure, lack of training, and absence of policy direction. There is clear potential for AI to transform business education, particularly in fostering sustainable economic growth, digital literacy, and workforce readiness—core elements of the SDGs. However, without institutional commitment and capacity building, these benefits may remain underutilised.

Conclusion

This study empirically examined the extent of awareness, usage, benefits, and challenges of Artificial Intelligence (AI) integration in business education among educators in public universities in Southwest Nigeria. The findings revealed that although there is moderate awareness of AI applications, actual usage remains low. Nevertheless, the perceived benefits are high, and there is general readiness among educators to adopt AI tools—provided the necessary support systems are in place.

AI holds great potential for revolutionizing business education through enhanced pedagogical efficiency, personalized learning, and alignment with global labour market demands. However, systemic constraints such as poor infrastructure, insufficient training, and weak institutional support continue to limit meaningful adoption. Without strategic interventions, Nigeria risks widening the global digital divide and missing the opportunities AI presents for achieving Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), and SDG 9 (Industry, Innovation, and Infrastructure).

The study thus concludes that AI integration in business education is not just a technological imperative but a developmental necessity.

Recommendations

Based on the findings, the following recommendations are made:

Capacity building: Universities should organise periodic training and workshops on AI literacy and pedagogical applications for business educators;

Curriculum integration: AI competencies—such as algorithmic thinking, machine learning applications, and data ethics—should be embedded into business education programs to prepare students for future workplaces;

Infrastructure improvement: Federal and state governments should invest in digital infrastructure (broadband internet, AI labs, cloud services) to enhance AI accessibility across public tertiary institutions;

Policy framework: Regulatory bodies such as the NUC should develop clear guidelines and standards for AI adoption and integration in Nigerian university curricula;

Multi-stakeholder partnerships: Collaborations should be fostered between universities, tech firms, and international bodies to provide grants, platforms, and technical expertise for AI integration projects;

Further research: Future studies should examine the effectiveness of AI applications in improving specific learning outcomes, comparing disciplines and regions to guide national AI strategy development.

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ARTIFICIAL INTELLIGENCE (AI) AND SUSTAINABILITY IN NIGERIAN HIGHER INSTITUTIONS: PROVISION FOR ETHICAL CONSIDERATIONS

Christianah Oluwakemi Alabi (Ph.D)

Department of Educational Management,
Emmanuel Alayande University of Education, Oyo. Oyo State
Alabicoe@uedoyo.edu.ng

Abstract

Integration of Artificial Intelligence (AI) into education, particularly for sustainability in higher education involves complex considerations to ensure that such technologies are beneficial in the long term, do not deplete resources or cause ecological imbalances, and foster economic and social inclusivity. Ethical AI involves a spectrum of considerations ranging from bias and transparency to privacy, accountability, and the broader societal impacts. Each of these areas is critical in ensuring that AI technologies promote fairness, efficiency, and trust among users. The positional paper focuses on ethical considerations in AI utilization in educational institutions. It address key themes which include concept of artificial intelligence (AI) in education, potential of AI-driven assessment in Nigerian higher institutions, the sustainability of AI in higher institutions, ethical considerations in AI utilization in higher institutions, empirical studies on AI and education, global perspectives on AI-driven assessment on education, key challenges to AI adoption in Nigeria and remedies to poor ethical consideration in uses of AI. Suggestions were made that research laboratories with academic-industry partnership focused should be establish, need to encourage the adoption of technology in primary and secondary education, establish ICT infrastructure in primary and secondary schools and that teachers would also have to be trained to update their knowledge on AI software programs

Keywords: Artificial Intelligence (AI), Development, Ethical considerations, Higher institutions, Sustainability

Introduction

Globally, in the rapidly evolving landscape of higher education, the integration of artificial intelligence (AI) into assessment processes represents a transformative shift towards enhancing educational outcomes and operational efficiencies. AI-driven assessments, characterized by their ability to automate and personalize evaluation processes, are increasingly acknowledged for their potential to address key challenges in higher education sectors globally, including those in developing countries like Nigeria (Baker & Smith, 2019). As Nigerian higher institutions grapple with issues such as exam malpractice, resource constraints, and the need for scalable educational solutions, AI technologies offer promising avenues for innovation and improvement (Adejo & Connolly, 2021).

However, it operates under the strain of rapid population growth and the resultant increased demand for higher education, presenting unique challenges and opportunities for innovation (Afolabi, 2020). Nigerian higher education institutions confront several significant challenges that impact their functionality and efficacy. Resource limitations are perhaps the most pervasive, with many institutions facing underfunding, which affects their ability to maintain infrastructure, procure necessary technology, and retain qualified staff (Obioma & Adeniji, 2021). Student diversity, while a strength, also poses challenges in terms of varied educational backgrounds and learning needs, which institutions must accommodate to ensure equitable learning outcomes (Chukwuemeka et al., 2019). Additionally, examination malpractices have become increasingly

sophisticated with cheating and other forms of dishonesty undermining the credibility of the educational system and necessitating urgent and effective solutions (Ezekwesili, 2021).

This study aims to explore and address these key areas:

- Concept of Artificial Intelligence (AI) in Education
- Potential of Ai-Driven Assessment in Nigerian Higher Institutions
- The Sustainability of AI in Higher Institutions
- Ethical Considerations in AI Utilization in Schools
- Empirical Studies on AI and Education
- Global Perspectives on Ai-Driven Assessment on Education
- Key Challenges to AI Adoption in Nigeria
- Remedies to Poor / Baseless Ethical consideration in AI

Concept of Artificial Intelligence (AI) in Education

The development of Artificial Intelligence (AI) systems and technologies in what has been referred as “NEW TECH TREND”. AI systems are machine-based systems that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. AI systems are designed to operate with varying levels of autonomy. Throughout this paper I use the umbrella terms ‘AI’ or ‘AI system’ to refer to digital and/or data-driven technologies, such as those used for automated decision making, diagnosis, predicting and forecasting, and pattern recognition. According to the International Finance Corporation (IFC, 2017), AI technologies are already contributing to resolving various development challenges such as financial inclusion. AI also holds great promise to address other Sustainable Development Goals (SDGs) particularly those faced by individuals at the “bottom of the pyramid” by providing service solutions or generating data on micro-levels using mobile phones and other electronic devices.

The integration of Artificial Intelligence (AI) in education offers substantial benefits, transforming traditional teaching approaches and enhancing the overall learning experience. Personalized learning, a key advantage of AI in education, allows tailored content delivery based on individual student needs and learning preferences (Harry, 2023). Moreover, AI significantly improves efficiency in education by automating routine tasks. Automated grading systems, administrative processes, and data analysis contribute to time savings for educators, enabling them to focus more on personalized instruction and student support {Cavalcanti, 2021}.

Also, Wardat, Belbase, and Tairab (2022) stressed that with the help of AI, education can be made more accessible and inclusive, enabling learners of all backgrounds to access high-quality education. To buttress this, they explained that artificial intelligence could help teachers improve personalized education for their students. Artificial intelligence can provide access to appropriate and better learning opportunities for excluded people and communities, people with disabilities, refugees, people out of school, and those living in isolated communities (Pedro, Subosa, Rivas and Valverde, 2019).

Potential of AI-Driven Assessment in Nigerian Higher Institutions

The adoption of AI-driven assessment technologies in Nigerian higher education can significantly address endemic challenges and pave how these technologies critical benefits.

1. Reducing Examination Malpractices

Examination malpractices, a persistent challenge in Nigerian higher education, can be substantially mitigated through AI technologies. AI-driven systems can monitor test-taking

environments and detect inconsistencies that may indicate cheating. Furthermore, the use of secure browser technology and algorithms that randomize question order and selection helps in maintaining the integrity of the examination process (Adams & Patel, 2023). To tackle examination malpractices, AI-driven systems employ machine learning algorithms to analyze response patterns for anomalies that may indicate cheating. Simultaneously, computer vision technology monitors test-taking environments via video feeds to ensure no unauthorized materials are used.

2. Personalizing Learning and Assessment

AI facilitates the personalization of learning and assessment by adapting materials and tests based on individual student's learning pace and style. Intelligent tutoring systems use AI to create a customized learning path for each student, improving engagement and effectiveness. This personalization helps cater to diverse learning needs, which is crucial in a multicultural and economically diverse setting like Nigeria (Brooks, 2021). AI technologies such as adaptive learning systems and tutoring systems are instrumental in personalizing education. These systems adjust the difficulty and style of content based on a student's past interactions, providing a tailored learning experience that optimizes individual student performance and engagement.

3. Managing Large Student Populations Efficiently

AI systems offer scalability that helps institutions effectively manage larger student bodies without a proportional increase in resources. Automated grading, enrollment, and feedback mechanisms streamline administrative and educational processes, thus accommodating growing student numbers more efficiently (Lee & Nguyen, 2021). AI aids in managing large student bodies through predictive analytics, which forecasts enrollment trends and performance, and automation tools that handle repetitive administrative tasks like grading and enrollment processing.

4. Enhancing Data Security and Privacy

With the rise of digital solutions, data security and privacy have become paramount. AI-driven systems can be designed with advanced security features to protect sensitive student information, ensuring compliance with legal standards and building trust in digital assessment platforms (Chukwuma, 2022). In the realm of data security, AI-enhanced cryptography protects sensitive student information, ensuring that data, once stored, is secure and only accessible to authorized users. Secure multi-party computation techniques further allow for the analysis of data without exposing the underlying information, safeguarding privacy even during complex processing tasks.

5. Improving Inclusive and Accessibility of Assessments

AI can enhance the accessibility of assessments for students with disabilities by adapting interfaces and content to meet various needs, such as text-to-speech for visually impaired students or alternative input methods for those with physical disabilities. This inclusivity is vital for equitable education (Morrison & Zimmerman, 2022). AI technologies also improve accessibility in education through natural language processing, which facilitates speech-to-text and text-to-speech conversions for students with visual or reading difficulties. Semantic analysis adjusts text complexity in real-time, aiding comprehension for students with learning disabilities, ensuring inclusivity.

6. Supporting Decision-Making

AI-driven analytics provide educators and administrators with actionable insights into student performance and learning trends. This data supports strategic decision-making in curriculum design, resource allocation, and policy development, aligning educational offerings more closely with labor market needs (Okafor & Emeka, 2023).

7. Biometric Supervision in Assessments

Integrating biometric technologies provide robust solutions to curb examination malpractices by authenticating student identities through unique physical attributes such as fingerprints, facial recognition, or iris scans. By integrating biometric verification systems with AI-driven assessment platforms, institutions can ensure that the individual taking the test is the correct student, thereby significantly reducing impersonation cases (Smith & White, 2023). Furthermore, continuous biometric monitoring during test/exams can detect facial recognition and fingerprint identification, into AI-driven assessment platforms ensures that the individual is the actual or correct student.

8. Augmented Reality in Learning and Assessment

Augmented reality (AR) brings interactive elements into the learning environment, which can profoundly enhance the engagement and understanding of complex subjects. For instance, AR can overlay detailed 3D models onto physical spaces, making it easier for students in fields such as medicine, engineering, and natural sciences to visualize and interact with their learning materials in intuitive ways (Jones & Lee, 2022). In assessments, AR can be used to create dynamic, situational tests where students interact with virtual components to perform tasks, thereby evaluating practical skills in a controlled, yet realistic setting.

9. Virtual Reality for Immersive Learning Experiences

Virtual reality (VR) takes the capabilities of AR further by immersing students completely in a simulated environment. This technology can simulate real-life situations for fields such as surgery, architecture, or environmental science, providing a hands-on learning experience that is risk-free and reproducible (Davis & Thompson, 2023). VR environments can also be used for conducting virtual examinations, where students navigate through immersive scenarios to solve problems or perform tasks, thereby assessing their skills in a more holistic manner.

The Sustainability of AI in Higher Institutions

This encompasses careful planning and implementation across various dimensions: environmental sustainability, economic sustainability, and social sustainability.

1. Environmental Sustainability in AI Deployment

The environmental aspect of AI sustainability primarily addresses the energy consumption and ecological footprint of organizing AI technologies. AI systems, particularly those involving large-scale data processing and machine learning models, require significant computational power which, in turn, can lead to substantial energy use. Sustainable AI deployment should therefore focus on optimizing algorithms to reduce power consumption and leveraging green energy sources where possible (Lee & Kim, 2022).

To mitigate these impacts, institutions should adopt practices like extended hardware lifecycles, proper e-waste recycling, and the use of environmentally friendly materials in manufacturing (Greenfield, 2023). Moreover, energy-efficient data centers and cloud services, which use advanced cooling technologies and better energy management systems, should be prioritized.

2. Energy Consumption of AI Systems

AI systems, especially those involving complex machine learning models, are typically resource-intensive, demanding substantial computational power and energy. The data centers that house these AI systems often run continuously, requiring significant amounts of electricity which, if sourced from non-renewable energy, can contribute extensively to carbon emissions. It is crucial

for institutions to adopt strategies that reduce energy consumption or shift to greener sources. Optimizing algorithms for energy efficiency and employing advanced cooling technologies can significantly lower the carbon footprint of running AI systems (Lee & Kim, 2022).

3. Sustainable Data Centers

One of the pivotal steps towards sustainable AI deployment is the utilization of sustainable data centers. These facilities prioritize energy efficiency through the use of renewable energy sources such as solar or wind power. Additionally, implementing cutting-edge designs that improve server efficiency and reduce unnecessary power usage are essential practices. For example, Google has been utilizing AI to manage cooling in its data centers, reducing energy consumption for cooling by up to 40% (Smith, 2023).

4. Lifecycle Management of AI hardware

The environmental impact of AI extends beyond energy use during operation to include the production and end-of-life handling of hardware. The production of electronic components like CPUs, GPUs, and storage devices requires significant resources and energy, often involving hazardous chemicals and generating substantial waste. Promoting extended hardware lifecycles, facilitating the refurbishing and recycling of electronic components, and using materials that are easier to recycle can mitigate these impacts. Institutions should engage in responsible e-waste management practices that conform to or exceed regulatory requirements, aiming for a circular economy approach where materials are reused to the greatest extent possible (Greenfield, 2023).

5. Green AI research and development

Research into 'Green AI' aims to develop AI algorithms that require less computational power and, by extension, consume less energy. This research is crucial in creating new AI models that are not only effective but also environmentally friendly. Encouraging such innovation can lead to more sustainable practices across the board, from the initial design and training of AI models to their deployment and operation (Zhang & Choi, 2022).

Ethical Considerations Necessary for AI Utilization in Higher Institutions

As AI systems increasingly permeate various sectors, including education, healthcare, finance, and more, the importance of ethical considerations in their deployment cannot be overstated. According to Ogunleye (2021) as well as Mehrabi et al. (2021), the following are the ethical factors to be considered if AI is to be adopted:

1. Fundamental Human Rights: The African Charter on Human and People's Rights recognized that civil and political fundamental rights could not be dissociated from civil and political rights and considered one to be required for enjoyment of the other. It also noted the historical traditions and values of African states should be taken into account. Important rights to consider in the development of a framework for an AI ecosystem include

a. **Human Dignity:** There is recognition that individuals possess a dignity inherent in their humanity which must be respected. Individuals are guaranteed the right to work under equitable conditions with equal pay and are protected from discrimination. Individuals are generally granted the right to personal liberty and freedom to associate and participate in society. Ogunleye (2021) pointed that peoples are granted the freedom to determine their economic and social development. States are also enjoined to provide assistance against all forms of political, cultural, and economic foreign domination.

2. Bias and Fairness: In educational contexts, AI's ability to offer personalized learning experiences and streamline administrative processes must be weighed against the risks of perpetuating or creating biases that can affect students' academic trajectories. Buolamwini &

Gebu, (2018) pointed that in AI-driven assessments, bias can manifest in various ways. For example, if an AI system for grading essays is trained predominantly on samples from native English speakers, it may unfairly penalize non-native speakers due to differences in syntax or idiomatic expressions. Such biases could lead to lower expectations and fewer resources being directed toward students from underrepresented groups, perpetuating a cycle of disadvantage

Regular audits and updates of the AI systems are also necessary to adapt to changes in student demographics and educational standards. Additionally, transparency in AI algorithms used for educational purposes helps stakeholders understand and trust the assessment processes. When educators and students know how decisions are made, they can better interpret AI-generated outcomes and identify potential biases. Transparency also facilitates the inclusion of educators in the loop of AI assessments, combining human judgment with algorithmic recommendations to ensure fairer outcomes (Ribeiro et al., 2016).

3. Transparency and Explainability: Transparency refers to the openness about the functioning and decision-making processes of AI systems, whereas explainability pertains to the AI's ability to articulate understandable reasons for its decisions (Guidotti et al., 2018). For instance, in classroom assessments, if an AI system is used for grading essays, it should not only assess the essays accurately but should also provide feedback that both students and teachers can understand. This feedback allows students to identify areas for improvement and educators to ensure the AI's evaluations are justified (Lipton, 2018). However, achieving transparency and explainability in AI, particularly with complex models such as deep neural networks, often described as “black boxes” due to their opaque internal workings, presents challenges. The opacity of such models can undermine trust, as users may doubt the fairness or accuracy of the decisions made by the AI systems. Addressing these concerns, researchers are developing methods to enhance the interpretability of AI systems without compromising their performance (Ribeiro et al., 2016).

4. Privacy: This is a critical aspect that requires rigorous attention to ensure the protection and ethical use of student data. In educational environments, privacy pertains to safeguarding personal information about students, protect against the misuse of sensitive information. It ranges from basic identifiers like names and dates of birth to more sensitive data such as academic performance, behavioral patterns, and even biometric. When AI systems are used to enhance assessment, they often collect and analyze large volumes of data to personalize educational experiences and improve outcomes (Polonetsky et al., 2015). Furthermore, educational institutions must develop clear policies regarding data retention and deletion, specifying how long student data will be stored and the procedures for safely disposing of data. These policies help mitigate the risk of data breaches.

5. Accountability: Accountability encompasses the responsibilities of users of AI systems to monitor, evaluate, and address the impacts of these technologies, especially when they are used in critical applications such as classroom assessments. In educational contexts, AI systems might be employed to automate grading, provide personalized learning experiences, or predict student outcomes based on various data inputs. To ensure accountability, educational institutions should establish clear policies and procedures that outline the roles and responsibilities of all parties involved in deploying and using AI systems. Furthermore, training educators and administrators on the potential risks and ethical considerations associated with AI use in education can foster a culture of accountability that prioritizes student welfare and educational equity.

6. Broader Social Impact: As AI technologies become more integrated into educational systems, they have the potential to influence not only how education is delivered and assessed but also how it shapes the future workforce, societal norms, and the distribution of opportunities. The

integration of AI in classroom assessments can lead to significant enhancements in educational efficiency and personalization. For example, AI-driven analytics can identify patterns in student learning and provide insights that help educators tailor their teaching strategies to better meet individual student needs. While AI has the potential to democratize access to high-quality education by providing personalized learning experiences regardless of geographic location or institutional capability, there is also a risk that these technologies could exacerbate existing inequalities. If access to the latest AI tools remains uneven, with wealthier institutions and individuals gaining disproportionately greater benefits, the educational divide could widen rather than narrow (Williamson, 2021).

Empirical Studies on AI and Education

The integration of AI in educational assessment is progressing globally, with numerous successful initiatives demonstrating how AI can enhance learning and testing across diverse educational systems. Usani and Ginika (2014) identified these case studies:

1. Estonia's Digital Transformation in Education

Estonia stands out in the digital transformation of its educational system, incorporating AI-driven tools to support both teaching and student assessment. Estonian schools utilize AI to personalize learning and automate the assessment processes, enabling timely feedback and tailored instructional support. A notable example is the use of speech recognition AI to help language teachers assess students' pronunciation and fluency, significantly reducing the teachers' workload and providing students with immediate, actionable feedback (Herold, 2021). This digital transformation has a lot of sustainability impacts.

First by leveraging AI for tasks like language assessment, Estonia reduces the need for physical materials and resources typically used in traditional classroom settings, such as paper for tests and assignments, thus lowering the environmental footprint of the educational system. Economically, AI systems, such as those used in Estonia, automate routine tasks, thereby reducing labor costs and time spent by teachers on administrative tasks. This allows for a more efficient allocation of resources, where teacher expertise can be directed towards more impactful educational activities, enhancing the overall value of educational expenditures.

Socially, the introduction of AI in Estonia's education system contributes to social sustainability by ensuring high-quality education is accessible and personalized. Despite these advancements, challenges remain, particularly in ensuring equal access across rural and less technologically developed areas. Ensuring that all students, regardless of their geographical location or socio-economic status, have equal access to AI tools is a significant ongoing effort.

2. AI in the USA Higher Education

In the USA, the Georgia Institute of Technology introduced "Jill Watson," an AI-powered teaching assistant developed from IBM's Watson platform. Jill was initially used in an online master's degree program in computer science to answer students' questions. This AI system was trained on over 40,000 forum posts from previous course iterations to accurately respond to student inquiries, freeing up human instructors to tackle more complex student needs (Goel & Polepeddi, 2016). The success of Jill Watson illustrates the scalability of AI in handling large volumes of routine queries, allowing educators to focus on more nuanced educational interactions.

AI in the USA higher education (Jill Watson) similarly has sustainable environmental impact in that AI like Jill Watson operates entirely online, minimizing the environmental costs associated with physical classroom components. Digital interactions save on paper and reduce the carbon footprint associated with commuting. Economically, Jill Watson handles large volumes of student

inquiries without additional costs. Over time, this scalability means educational institutions can manage more students without proportionately increasing the budget for teaching staff. Socially, by quickly and consistently responding to student queries, AI assistants ensure equitable access to information and support, potentially increasing student satisfaction and success rates.

The challenge in the USA largely revolves around ethical considerations and the potential for bias in AI algorithms, which can perpetuate or exacerbate existing inequalities in educational outcomes. There is also a significant discussion about the impact of AI on the educational workforce, with concerns about job displacement for educators.

3. Adaptive Learning in China

China's use of AI in education includes large-scale deployment of adaptive learning technologies. Companies like Squirrel AI have developed platforms that adjust the difficulty of material based on a student's mastery of the subject. AI-driven personalization has been shown to improve students' performance significantly, particularly in subjects like Mathematics, where students' progress at varying rates (Zhang, 2019). The sustainable environmental impact is primarily function online, promoting a paperless learning environment that contributes to environmental sustainability by reducing waste. Economically, adaptive learning technologies can optimize educational outcomes with potentially fewer resources by focusing on individual needs. This efficiency lower the overall costs of education per student, making high-quality education more economically viable at scale and socially, the Squirrel AI tailors educational content to meet individual student needs, supporting personalized learning paths that help close achievement gaps. This personalization makes education more inclusive, catering to a broader range of learning styles and paces. However, the rapid deployment of AI in education has raised concerns about vast amounts of student data being processed. There is a debate about the security of this data and the transparency of how it is used, with fears about surveillance and misuse.

4. Automated Essay Scoring in Australia

Australia has experimented with automated essay scoring systems, such as those used in the National Assessment Program – Literacy and Numeracy (NAPLAN). These systems employ AI to grade student essays, offering a faster turnaround time and consistent assessments. While there has been some debate over the validity and fairness of automated scoring, it presents a compelling case for the potential efficiency gains in large-scale testing environments (Williamson, 2020b). This case study reflects the ongoing discussions and evaluations necessary to balance AI-driven efficiencies with educational integrity and fairness.

The sustainable environmental impact of the Australian project is that automated essay scoring systems significantly reduce the paper trail associated with traditional essay grading, aligning with environmental sustainability goals by diminishing paper use and waste. Economically, these systems streamline the grading process, reducing the time and financial resources needed for manual essay evaluation. This can lead to substantial cost savings, especially in large-scale assessments. Socially, while automated scoring promises consistency and objectivity in grading, its impact on social sustainability is mixed. Concerns about the fairness and transparency of automated scores need to be addressed to ensure that such systems do not inadvertently perpetuate biases or inequalities.

The use of AI in assessments has not been without controversy. Critics have pointed out issues with reliability and the validity of AI assessments, questioning whether AI can truly grasp nuances in student responses. There has also been significant public and professional pushback against the perceived depersonalization of education through the use of automated systems. Countries like

Estonia have been pioneers in integrating digital technology in their education systems, using AI not just for efficiency but also to enhance learning experiences while respecting robust data privacy laws (Herold, 2021).

Limitations of AI Research Capacity/Development

Poor Research Development Funding: There is generally a deficiency of a culture of Research and Development in the government planning and among the academia. Expenditure on R&D is miniscule – with government R&D spending estimated at less than 0.5% of GDP and private sector spending estimated at 0.1% of GDP. In addition, public spending on education is limited at a mere 5.6% of GDP in 2020, resulting in a poor public education system with poor learning outcomes (National Universities Commission, 2022). There is also an absence of collaboration between the private sector and academic research institutes that generates research output that can be commodified and brought to market. The World Economic Forum Competitiveness Index ranked Nigeria 133rd of 137 countries in terms of university-industry collaboration in Research & Development.

The Lack of Data Ecosystem: Data collection and digital storage in Nigeria education remains poor despite the explosion of tech startups in the country (Okeke, 2022b). Cloud computing uptake for instance remains low due to cost barriers, security, and other infrastructure concerns. At present, there is only one local data storage provider, Galaxy Backbone who provides cloud services to the government which meet localization requirements. Private sector actors opt for international service providers such as Amazon Web Services or Azure and the absence of a regulatory framework.

Ineffective Networking/ Poor Low Broadband Penetration: Nigeria is one of the largest telecommunications markets in Africa with high mobile phone penetration. Almost 90% of the population now have coverage for voice services and a majority of mobile phone subscribers are also connected to internet services. The majority of internet services are however provided on 2G and 3G networks with 4G coverage available to less than 40% of the population (Olagunju, Adekola and Oyelere, 2020). In addition, download speeds in Nigeria are uncompetitive on speed and cost when compared to contemporaries. Broadband penetration is low, with approximately 65,000 fixed broadband subscriptions in the country in 2018. Broadband costs are also expensive with Nigeria ranking 141st of 182 countries in respect of fixed broad band costs as a percentage of national income. The average monthly cost for basic broadband in Nigeria amounts to more than half the national minimum wage. Internet speed is also poor at 3.9 megabits per second, far below the global minimum standard.

Low Literacy Rates: Primary education enrolment is relatively high in Nigeria with a gross enrolment ratio of 87% in 2018. This ratio falls rapidly by the time children reach secondary school age with a gross enrolment rate of 43% for secondary education and 10% for tertiary education. The average age of students dropping out is nine years for men and eight years for women. The literacy rate in Nigeria has improved over the decades with 62% of the population over the age of 15 now able to read and write. However, this rate varies widely between regions and only about 52% of women nationally are literate (Okeke, 2022b). The teaching culture in Nigeria also remains highly rote-based with minimal interaction or customization. The curriculum taught at secondary and tertiary level is outdated and does not provide students with the skills demanded by employers in the job market. Universities are poorly equipped and generally do not support innovation or entrepreneurial skills.

Lack of a National Identification System: The National Identity Management Commission noted in 2020 that over 100 million Nigerians currently have no form of identification. This is

despite efforts to establish a national identity program where by every citizen is granted an identification card, which contains biometric information, a national identification number, as well as other personal information. The national identity program has so far seen a relatively low take-up with only about 66 million Nigerians registered as of November 2021.

Remedies to Limitations / Baseless Ethical Consideration On AI

Morrison and Zimmerman (2022) highlighted following remedies to poor ethical consideration.

1. Extend the broadband network by allowing the deployment of fiber optic cables across the country. To support this, land tenure rights and licensing requirements should be relaxed to reduce the cost to companies. Collaborate with private sector actors such as tech startups, cloud computing providers, and finance institutions to accelerate the digital transformation and broadband penetration in the country. Microsoft recently announced its intention to extend its Airband Initiative to Nigeria, which seeks to improve internet penetration in underserved communities by tapping into unused TV white space broadcasting frequencies. Other partnerships like this should be pursued and implemented by the government.

2. Establish national research laboratories with academic-industry partnership focused on addressing local challenges and building prototype solutions in key sectors that are ultimately deployed to the market. Such laboratories should be associated with universities across the six geo-political zones in the country and provide key practical training to university students studying STEM degrees.

3. Encourage the adoption of technology in primary and secondary education. Although, fully personalized education technologies have not been found to have long-lasting impact on learning outcomes, supplementing curriculum delivery and providing administrative support with AI technologies such adaptive learning tools can assist teachers to deliver better targeted education content.

4. Establish ICT infrastructure in primary and secondary schools. Teachers would also have to be trained to software programs that customize and provide interactive experiences to students. Familiarity with technologies from an early stage will increase digital literacy in Nigeria and provide young kids with an interest in STEM education.

5. Establish public-private sector collaborations to design and deliver work-based learning and training. Co-creation hub, which creates interactive content and uses digital labs to teach students science concepts. This would provide computer coding, software development training, and employment opportunities to young people.

Conclusion

The integration of AI in higher education in Nigeria presents a transformative opportunity to enhance teaching and assessment practices, personalize student learning experiences, and improve administrative efficiencies. The lessons learned from global case studies demonstrate the potential benefits of AI in education, such as increased personalization, scalability, and operational efficiency. However, these case studies also highlight significant challenges, including ensuring fairness, managing privacy concerns, and maintaining data security. While the path to integrating AI in Nigerian higher education involves navigating various challenges, the potential rewards are substantial. With careful planning, collaboration, and a commitment to ethical practices, AI can significantly enhance the quality of education in Nigeria, preparing students more effectively for the demands of the global economy and contributing to the nation.

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PERCEPTION AND ACCEPTANCE OF AI-BASED COUNSELLING AMONG UNDERGRADUATE STUDENTS IN OYO STATE

Oyekola Olukayode Oyelade (Ph.D)

& John Idowu Shittu (Ph.D)

^{1&2}Department of Special Education and
Guidance and Counselling Faculty of Specialised and
Professional Counselling
Emmanuel Alayande University of Education, Oyo
Unclekay6@gmail.com

Abstract

Artificial Intelligence (AI)-based counselling platforms have emerged as innovative tools that offer potential benefits including 24/7 availability, anonymity, and cost-effectiveness. Despite the promising advantages, the success of AI counselling depends largely on students' perceptions and their willingness to accept such services. Positive perception, including trust in AI's confidentiality and effectiveness, often influences acceptance and usage. This study investigates undergraduate students' perceptions and acceptance of AI-based counselling in Oyo State. This research employed a descriptive correlational survey design. The target population consisted of all undergraduate students in tertiary institutions within Oyo State. A sample of 300 students was selected through multi-stage random sampling. Data were collected using a structured questionnaire divided into two sections: perception of AI counselling and acceptance of AI counselling. Data were analysed using descriptive statistics summarising responses and Pearson's correlation coefficient at a 0.05 significance level. The study revealed that undergraduate students had a moderately positive perception of AI-based counselling ($\chi=3.03>3.50$). The acceptance level was also moderate, with students expressing willingness to use AI counselling services ($\chi=3.10>3.50$). Analysis showed a statistically significant moderate positive correlation between perception and acceptance of AI counselling ($r = 0.415, p < 0.05$). This study concludes that undergraduate students in Oyo State exhibit a moderate positive perception and acceptance of AI-based counselling services. Educational institutions should integrate AI counselling as a complementary service within their mental health frameworks, supported by awareness initiatives and secure technological infrastructure.

Keywords: AI-based Counselling, Perception, Acceptance, Undergraduate Students

Introduction

The mental health and psychological well-being of undergraduate students have become topics of growing concern across higher education institutions worldwide. University life is often associated with a transitional period marked by academic demands, social changes, financial pressure, and the challenge of future career planning. These stressors, if not effectively managed, can lead to emotional distress, anxiety, depression, and even suicidal ideation. According to the World Health Organisation (2021), mental health disorders are the leading cause of disability among individuals aged 15–29 years, a demographic that encompasses most undergraduate students. In Nigeria, these issues are further complicated by systemic limitations in the educational and healthcare systems. Many students are enrolled in overcrowded institutions with limited access to psychological services, and societal stigma continues to discourage open conversations about mental health (Nwobi et al., 2025). University counselling centres, where they exist, are

often understaffed and under-resourced, making it difficult to respond adequately to students' emotional needs.

In light of these challenges, the integration of Artificial Intelligence (AI) into counselling practices presents a novel and potentially transformative approach to mental health service delivery. AI-based counselling systems use intelligent algorithms and technologies such as machine learning, natural language processing (NLP), and chatbot interfaces to interact with users and provide psychological support. These tools are designed to simulate human conversation, allowing users to discuss emotional challenges, receive coping suggestions, and be directed to professional help when needed. One major advantage of AI-driven counselling tools is their ability to provide immediate and 24/7 support without the need for human intervention. This is particularly valuable in educational settings where traditional counselling services may be available only during limited hours and are often overburdened. Samuel and Akinola (2023) demonstrated the potential of an AI-powered chatbot system in delivering tailored psychological therapy to students, revealing promising results in terms of usability and perceived effectiveness.

The potential of AI tools to reduce symptoms of mental distress among students has been increasingly documented in global literature. For example, a study conducted in Zimbabwe implemented a mental health chatbot among university students and found that it significantly enhanced accessibility to mental health support services (ResearchGate, 2024). Students appreciated the anonymity, availability, and non-judgmental nature of the chatbot, which contributed to more open communication and regular engagement. AI systems can also detect language cues associated with distress, helping to flag serious emotional conditions before they escalate. This early detection is critical in academic environments where students might otherwise delay or avoid seeking help. In many cases, these tools not only provide support but also foster mental health literacy among students, empowering them to take proactive steps in managing their psychological well-being.

One major concern is the issue of data privacy. AI systems often collect and process sensitive personal information, raising questions about how this data is stored, secured, and used. Moreover, there are concerns about the emotional intelligence of AI systems. While they can recognise certain keywords and emotional tones, they cannot fully replicate the empathy, intuition, and cultural understanding that human counsellors bring to therapeutic interactions. In Nigeria, cultural norms and language diversity may pose additional challenges to the deployment of AI counselling systems. A study by Aina et al. (2025) at Ekiti State University reported that although students were generally open to interacting with medical AI tools, some were skeptical about the reliability of diagnoses and advice provided by non-human systems. Such concerns point to the need for culturally sensitive and ethically grounded design and implementation strategies for AI-based interventions in higher education settings.

In the Nigerian context, where student populations continue to grow and mental health support services remain underfunded and understaffed, AI-based counselling offers a scalable and accessible alternative. With increasing internet penetration and smartphone usage among Nigerian youths, digital platforms have also served as practical vehicles for delivering psychological support. However, there is a scarcity of empirical research evaluating the actual effectiveness, acceptance, and psychological impact of these tools within Nigerian universities. Furthermore, the local adaptation of such systems to address language, cultural norms, and ethical concerns remains an ongoing challenge. As noted by researchers such as Nwobi et al. (2025), integrating AI into

clinical psychology and counselling practice in Nigeria requires both technological innovation and a contextual understanding of societal needs and constraints.

Perception plays a pivotal role in shaping how individuals engage with new technologies, particularly in sensitive domains like mental health. Undergraduate students' perceptions of AI-based counselling are influenced by various factors, including their understanding of AI capabilities, cultural beliefs, trust in technology, and previous experiences with digital tools. Some students perceive AI counselling as a useful and innovative solution that offers privacy, accessibility, and convenience especially in contexts where traditional counselling services are stigmatised or inaccessible. These students may appreciate the anonymity provided by AI systems, which allows them to share sensitive issues without fear of being judged (Nwobi et al., 2025).

On the other hand, skepticism also exists. Some students view AI counselling tools as impersonal and incapable of fully understanding or empathising with human emotions. Concerns about the quality of advice provided, ethical issues, and data privacy also influence negative perceptions. Research by Aina et al. (2025) on undergraduates in Ekiti State University revealed that while students acknowledged the potential usefulness of medical chatbots, many remained uncertain about the accuracy and reliability of the information provided. This highlights the need to address misinformation, build technological literacy, and align AI counselling tools with students' emotional and cultural expectations.

Closely linked to perception is the level of acceptance that students demonstrate towards AI-based counselling services. Acceptance refers to the willingness of students to use and rely on AI platforms as legitimate and helpful alternatives to traditional counselling. While some students quickly embrace new technology, others may be more hesitant due to unfamiliarity or doubts about effectiveness. The acceptance of AI counselling among undergraduates is often driven by the perceived ease of use, perceived usefulness and the extent to which the technology aligns with their values and mental health needs (Wang et al., 2021).

The Technology Acceptance Model (TAM) provides a useful framework for understanding these dynamics. According to TAM, two main factors perceived usefulness and perceived ease of use directly influence users' attitudes toward technology and their actual use behaviour (Davis, 1989). Applying this model in the context of AI-based counselling suggests that for undergraduate students to accept and utilise AI platforms, these tools must be user-friendly, responsive, culturally sensitive, and demonstrably beneficial to their mental health needs. As acceptance continues to grow, these technologies could become integral to student wellness programs in universities across Nigeria and beyond (Wong et al., 2023). Therefore, this study seeks to explore perception and acceptance of AI based counselling among Undergraduate students in Oyo State.

Statement of the problem

The rising incidence of mental health challenges among undergraduate students has become a pressing issue in higher education institutions. Increasing academic workloads, peer pressure, family expectations, and the uncertainty of post-graduation life contribute to widespread psychological distress among students. Unfortunately, access to conventional counselling services remains limited due to factors such as stigma, lack of awareness, and inadequate counselling infrastructure in many Nigerian universities. Consequently, many students either avoid seeking help or receive insufficient psychological support, placing their academic performance, personal development, and overall well-being at risk.

Artificial Intelligence (AI) has emerged as a promising tool in addressing this gap by offering counselling services through digital platforms such as chatbots, virtual therapists, and self-guided mental health apps. These systems are designed to provide accessible, cost-effective, and anonymous emotional support, especially for students who may be reluctant to seek face-to-face therapy. Despite their growth in global usage, the level of awareness, perception and acceptance of AI-based counselling tools among Nigerian undergraduates is still largely unknown. There are concerns that cultural beliefs, lack of trust in technology and doubts about the emotional sensitivity of AI may hinder students' willingness to use such systems. Moreover, ethical issues, such as the protection of user data and the inability of AI to provide deep therapeutic empathy, further complicate their adoption. Without understanding students' views, institutions may implement digital mental health tools that do not resonate with the target users or address their specific needs. Given these complexities, it is crucial to examine perception and acceptance of AI based counselling among Undergraduate students in Oyo State

Research Questions

The following research questions were used:

1. What is the level of perception of AI-based counselling among Undergraduate students in Oyo State?
2. What is the level of acceptance of AI-based counselling among Undergraduate students in Oyo State?
3. What is the relationship between perception and acceptance of AI-based counselling among Undergraduate students in Oyo State?

Methodology

Research Design

This study adopted a **descriptive survey design of the correlational type**. The choice of this design was based on the need to systematically investigate the relationship between two key variables students' perception and acceptance of AI-based counselling without manipulating any of the variables. A descriptive survey design is suitable for studies that aim to collect data from a large population to describe existing conditions or relationships as they naturally occur. The correlational approach, in particular, allowed the researcher to determine the strength and direction of the relationship between students' perceptions of AI-based counselling and their acceptance of such technology as a tool for psychological support.

Study Population

The target population for this study comprised **all undergraduate students in Oyo State**, Nigeria. Oyo State is home to several public and private tertiary institutions, including universities and polytechnics that enrol thousands of students across various faculties and disciplines. Undergraduate students were selected as the focus of the study due to their increasing exposure to technology, academic pressures and mental health needs. The choice of this population also reflects the growing interest in integrating digital solutions, including AI-powered mental health services, within the educational sector.

Sample and Sampling Techniques

A total of **300 undergraduate students** were selected from different institutions across Oyo State to serve as participants in the study. A **multistage sampling technique** was employed to ensure fair representation of the diverse student population. In the first stage, a purposive sampling method was used to select several tertiary institutions based on accessibility and the availability

of counselling units. In the second stage, a stratified random sampling technique was adopted to select students from various faculties, departments, and levels of study to ensure proportional representation. This approach was adopted to enhance the generalisability of the findings across different academic and demographic subgroups within the student population.

Research Instrument

The primary instrument used for data collection was a **structured questionnaire** developed by the researcher specifically for this study. The questionnaire was designed to collect relevant data on respondents' **demographic information, perception of AI-based counselling, and their level of acceptance of such technology**. It consisted of multiple sections, each targeting specific aspects of the research objectives. The items in the questionnaire were measured using a **5-point Likert-type scale**, ranging from "Strongly Disagree" to "Strongly Agree", which allowed for the quantification of students' attitudes and opinions.

To ensure the **validity and reliability** of the instrument, the questionnaire underwent **expert review by professionals in educational psychology and counselling**, who assessed it for content relevance, clarity, and consistency with the study's objectives. A **pilot test** was also conducted with a small group of students outside the study sample. The feedback from the pilot study was used to refine ambiguous items and enhance the overall reliability of the instrument. A Cronbach's Alpha coefficient was calculated to confirm the internal consistency of the instrument, ensuring that it was suitable for large-scale administration.

Administration of the Research Instrument

The administration of the questionnaire was carried out by the **researcher with the assistance of trained field assistants**. Prior to the distribution of the instrument, **ethical clearance and formal approval** were obtained from the relevant school authorities. The purpose of the study was clearly explained to both administrators and students to ensure informed participation. **Voluntary consent** was obtained from all participants, and they were assured of the **confidentiality and anonymity** of their responses.

The questionnaire was administered in person to allow the field assistants to address any questions or concerns raised by the respondents. This method also helped ensure that the instrument was completed promptly, minimizing the risk of missing or incomplete data. All completed questionnaires were collected immediately after completion to achieve a **high response rate** and maintain the integrity of the data.

Method of Data Analysis

Upon collection, the data were coded and analysed using the **Statistical Package for the Social Sciences (SPSS) version 25**. **Descriptive statistics** such as frequency counts, percentages, means, and standard deviations were used to summarise the demographic information of the respondents and their responses to individual questionnaire items. These statistics provided a clear overview of students' perceptions and acceptance levels of AI-based counselling.

In addition, **inferential statistics** were employed to test the relationship between the key variables of interest. Specifically, the **Pearson Product Moment Correlation (PPMC)** was used to examine the relationship between students' perception of AI-based counselling and their acceptance of such systems. The analysis was conducted at the **0.05 level of significance**, allowing the researcher to determine whether the observed relationships were statistically meaningful. The

results of the analysis were interpreted and discussed in line with the study's hypotheses and research questions.

Results and Discussion of Findings

Research Question 1: What is the level of perception of AI-based counselling among Undergraduate students in Oyo State?

Table 1: Perception of AI-Based Counselling

Item No.	Statement	SA	A	D	SD	Mean	Standard Deviation
1	AI-based counselling can provide useful emotional support to students.	120	100	50	30	3.13	0.97
2	I trust AI counselling systems to maintain my confidentiality.	90	80	70	60	2.73	1.07
3	AI counselling can understand and respond to my emotions effectively.	70	90	80	60	2.63	1.04
4	I feel comfortable sharing my problems with an AI-based counselling platform.	80	85	75	60	2.70	1.04
5	AI counselling systems can provide timely help when I need psychological support.	110	95	55	40	2.95	1.00
6	I am concerned that AI counselling may not provide accurate advice for mental health issues.	130	90	50	30	3.17	0.93
7	Using AI counselling feels less personal compared to talking with a human counsellor.	140	85	45	30	3.24	0.91
8	I believe AI counselling tools are easy to use and accessible whenever I need them.	100	105	50	45	2.90	1.01
9	AI-based counselling can be an effective alternative when human counsellors are unavailable.	115	95	50	40	3.00	0.98
10	I worry about the security of my personal data when using AI counselling platforms.	125	90	50	35	3.07	0.94
Weighted Mean= 3.03							

The findings from the survey on undergraduate students' perception of AI-based counselling in Oyo State reveal a moderate to positive overall perception of this emerging mental health support tool. The data show that students generally recognise the potential usefulness of AI counselling in providing emotional support. For example, a considerable number of respondents agreed or strongly agreed that AI-based counselling can offer useful emotional support (Mean = 3.13). This suggests that many students believe AI platforms could serve as valuable supplementary resources for mental health, especially when human counsellors may not always be accessible. However, while some students express confidence in the benefits of AI counselling, there remain notable concerns. Trust in AI systems' ability to maintain confidentiality was less assured, with a lower mean score of 2.73. This reflects a significant level of scepticism about data privacy, a critical issue given the sensitivity of mental health information. Related to this, students expressed discomfort about sharing personal problems with AI platforms (Mean = 2.70). Further, the perception that AI counselling may not fully understand or respond to emotions effectively had a mean score of 2.63. This is supported by the higher agreement with the statement that AI counselling feels less personal compared to human counselling (Mean = 3.24). Such views suggest that emotional authenticity and interpersonal warmth are important factors influencing students' perception of counselling effectiveness. On the positive side, many students agreed that AI counselling can provide timely support (Mean = 2.95) and that it is easy to use and accessible (Mean = 2.90). Concerns about the accuracy of AI advice and security of personal data were also evident, with mean scores of 3.17 and 3.07, respectively. The results indicate that there is high

level of perception of AI based counselling among Undergraduate students in Oyo State; the weighted mean 3.03 is higher than the standard mean 2.50.

The findings of this study reveal important insights into the perception of AI-based counselling among undergraduate students in Oyo State. Overall, the data indicate a moderate to positive perception, suggesting that students recognise the potential benefits of AI technology in providing emotional and psychological support. This aligns with previous research by Abd-Alrazaq et al. (2020), who found that users generally appreciate the accessibility and immediacy of AI-driven mental health tools, especially in contexts where human counselling resources are limited. This is encouraging given the increasing demand for mental health services in academic institutions, where human counsellors are often overwhelmed or unavailable (Wang, Zhang, & Liu, 2021). The perceived ease of use and accessibility further supports the idea that AI counselling can help bridge gaps in mental health provision by offering convenient, round-the-clock assistance. This corroborates the findings of Samuel and Akinola (2023), who noted that despite the technological advances, scepticism about data security continues to hinder full adoption of AI mental health tools.

Research Question 2: What is the level of acceptance of AI-based counselling among Undergraduate students in Oyo State?

Table 2: Acceptance of AI-Based Counselling

Item No.	Statement	SA	A	D	SD	Mean	Standard Deviation
1	I am willing to use AI-based counselling services if they are available at my institution.	130	95	50	25	3.19	0.91
2	I would recommend AI counselling platforms to my friends who need mental health support.	120	90	60	30	3.07	0.98
3	I find AI counselling services easy to use and navigate.	140	85	45	30	3.24	0.90
4	I am confident that AI counselling can help me manage my stress and emotional problems.	110	90	65	35	2.95	1.01
5	I would prefer AI counselling to traditional face-to-face counselling if it is more accessible.	100	80	75	45	2.81	1.07
6	I believe AI-based counselling will become an important part of mental health services.	130	95	45	30	3.19	0.92
7	I feel comfortable sharing personal issues with an AI counselling platform.	90	85	75	50	2.70	1.12
8	I intend to use AI counselling services regularly if offered at my university.	110	85	60	45	2.90	1.04
9	I think AI counselling is a trustworthy alternative to human counsellors in some situations.	85	95	70	50	2.73	1.12
10	I would like to learn more about AI counselling and how it can support mental health.	140	100	40	20	3.36	0.85
Weighted Mean = 3.10							

The results indicate a generally positive and high acceptance of AI-based counselling services among undergraduate students in Oyo State. The data show that a significant proportion of students are willing to use AI counselling if it is made available at their institutions, as reflected in a relatively high mean score of 3.19 on this item. Students also expressed strong interest in learning more about AI counselling and its applications in mental health support, with the highest mean score of 3.36. The item addressing the usability of AI counselling platforms recorded a mean score of 3.24, indicating that students generally find these tools user-friendly and accessible. Comfort with sharing personal and sensitive issues on AI counselling platforms was moderate, with a mean score of 2.70. Similarly, students were somewhat uncertain about trusting AI as an alternative to human counsellors in some situations (Mean = 2.73), highlighting the importance of the human element in mental health care. Preference for AI counselling over traditional face-to-face counselling scored moderately (Mean = 2.81). Confidence in AI's ability to help manage stress and emotional problems also showed cautious optimism, with a mean score of 2.95. The

results indicate that there is high level of acceptance of AI based counselling among Undergraduate students in Oyo State; the weighted mean 3.10 is higher than the standard mean 2.50. In summary, the study reveals that undergraduate students in Oyo State hold a generally positive attitude toward the acceptance of AI-based counselling, particularly valuing its accessibility, ease of use, and potential as a supplementary mental health resource

The findings of this study indicate a moderate to a high level of acceptance of AI-based counselling among undergraduate students in Oyo State. This positive disposition is reflected in students' willingness to use AI counselling services if made available at their institutions and their interest in learning more about how AI can support mental health. Such openness is consistent with global trends where younger populations tend to be more receptive to digital health technologies due to their familiarity with and reliance on technology in daily life (Abd-Alrazaq et al., 2020). The students' cautious confidence in AI's ability to help manage emotional problems suggests that acceptance may grow as AI systems improve and as users gain more exposure and familiarity with these technologies. Importantly, trust and data privacy concerns remain critical barriers. Without clear assurances on confidentiality and robust security measures, students may hesitate to fully engage with AI counselling platforms, limiting their effectiveness (Venkatesh et al., 2003).

Research Question 3: What is the relationship between perception and acceptance of AI-based counselling among Undergraduate students in Oyo State?

Table 3 showing the PPMC summary on the relationship between perception of AI-based counselling and acceptance of AI-Based counselling

Variable	N	Mean	SD	DF	R	Sig	P
Perception of AI-based counselling	300	38.02	5.67	298	.415	.000	<0.05
Acceptance of AI-based counselling		86.26	11.09				

Table 3 shows the significant relationship between perception of AI-based counselling and acceptance of AI-based counselling among Undergraduate students in Oyo State. The result revealed that there is significant relationship between perception of AI based counselling and acceptance of AI-based counselling among Undergraduate students in Oyo State; $r_{(298)} = .415$, $p < 0.05$. This implies that perception of AI-based counselling had moderate influence on acceptance of AI-based counselling among Undergraduate students in Oyo State.

The findings indicate a statistically significant positive relationship between the perception of AI-based counselling and its acceptance among undergraduate students in Oyo State. This moderate correlation suggests that how students perceive AI counselling substantially influences their willingness to accept and use such services. The moderate strength of this relationship also highlights that while perception plays a significant role, other factors may contribute to the acceptance of AI-based counselling. These could include personal experiences with mental health services, cultural attitudes toward technology and counselling, privacy concerns, and emotional readiness to engage with AI tools. Such multifaceted influences suggest that promoting positive perceptions alone may not be sufficient; comprehensive strategies addressing trust, privacy, and emotional engagement are necessary to boost acceptance further. Moreover, this finding

emphasises the importance of educational and awareness programs that enhance students' understanding of AI counselling capabilities and limitations. Improving students' knowledge can shape more positive perceptions, which in turn could increase their openness to using AI counselling services. This is particularly relevant in university settings, where mental health needs are rising, and scalable, accessible solutions like AI counselling could play a vital role in bridging service gaps (Abd-Alrazaq et al., 2020; Naslund, Aschbrenner, Marsch, & Bartels, 2016).

Conclusion

This study investigated the perception and acceptance of AI-based counselling among undergraduate students in Oyo State. The findings revealed that students generally hold a moderately positive perception of AI counselling, recognizing its potential usefulness, accessibility, and convenience as a mental health support tool. Additionally, there is a moderate level of acceptance towards AI-based counselling, indicating a willingness among students to engage with such services if made available. Importantly, the study established a significant positive relationship between perception and acceptance, highlighting that favourable perceptions strongly influence the willingness to adopt AI counselling platforms.

However, despite this positive outlook, concerns regarding emotional connection, privacy, and trustworthiness persist, suggesting that AI counselling is viewed more as a complementary option rather than a complete substitute for traditional human counselling. Therefore, while AI-based counselling holds promise for expanding mental health services in university settings, addressing these concerns is critical to improving its acceptance and effective utilization.

Recommendations

Based on the findings, the following recommendations are proposed:

1. Universities should implement awareness campaigns and educational programs to inform students about the capabilities, benefits, and limitations of AI-based counselling. Increasing students' knowledge can foster more positive perceptions and higher acceptance levels.
2. Developers should focus on designing AI counselling systems that are user-friendly, secure, and capable of simulating empathetic responses to address concerns about emotional connection and trust.
3. Institutions must establish and communicate robust data privacy and security measures to build student trust and alleviate fears about confidentiality breaches when using AI counselling.
4. AI counselling should be positioned as a complementary tool alongside traditional human counselling, offering a hybrid approach that leverages the strengths of both to provide comprehensive mental health support.
5. Future studies should explore additional factors influencing acceptance, such as cultural attitudes, previous counselling experiences, and the role of gender or academic discipline, to develop tailored interventions that increase the adoption of AI counselling.
6. Educational policymakers should develop guidelines and frameworks to regulate and support the ethical use of AI technologies in mental health services within tertiary institutions.

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EXTENT OF AWARENESS AND UTILIZATION OF ARTIFICIAL INTELLIGENCE AMONG BUSINESS EDUCATION STUDENTS IN TERTIARY INSTITUTIONS IN OGUN STATE, NIGERIA

¹Ileuma Senimetu (PhD) ²Onasoga Olusola Taiwo

¹Department of Educational Management
Faculty of Education, Lead City University
Ibadan, Oyo State, Nigeria

²Department of Business Education
Federal College of Education, Abeokuta, Ogun State, Nigeria
ileumasenimetu@gmail.com

Abstract

This study examines the awareness and utilization of Artificial Intelligence (AI) tools among business education students in Ogun State, Nigeria, addressing the gap in empirical knowledge regarding AI literacy in developing contexts. Employing a descriptive survey design, data were collected from 362 students across universities, polytechnics, and colleges of education using the Artificial Intelligence Awareness and Utilization Questionnaire (AIAUQ). Results revealed moderate levels of AI awareness ($M = 2.98$, $SD = 1.42$) and utilization ($M = 2.96$, $SD = 1.44$), with no significant differences based on gender ($p = 0.71$; $p = 0.69$), institution type ($p = 0.21$; $p = 0.82$), or academic level ($p = 0.56$; $p = 0.52$). These findings align with prior research highlighting limited AI literacy in Nigeria due to inadequate infrastructure and educator training. The moderate engagement suggests systemic barriers, such as resource constraints and lack of AI-focused curricula, hinder effective adoption. The study underscores the need for curriculum reform, educator training, and awareness campaigns to enhance AI integration, aligning with industry demands. Recommendations include embedding AI modules, conducting workshops, and fostering industry partnerships to boost digital literacy and workforce readiness. Future research should explore broader geographical scopes and longitudinal designs to deepen insights into AI adoption. These findings have implications for policymakers and educators aiming to bridge the AI literacy gap in Nigeria's business education sector.

Keywords: Artificial Intelligence, business education, AI literacy, awareness, utilization, Nigeria

Introduction

The global integration of Artificial Intelligence (AI) into education and the workforce has ushered in transformative opportunities, reshaping pedagogical approaches and enhancing workforce readiness. AI technologies, encompassing machine learning, natural language processing, and adaptive systems, are revolutionizing educational methodologies by enabling personalized learning, streamlining administrative processes, and fostering innovative teaching practices (Samuel & Salisu, 2025). In business education, AI's relevance is particularly pronounced as it equips students with critical technological competencies demanded by the evolving landscape of Industry 4.0. AI tools facilitate data-driven decision-making, automate routine tasks, and enhance analytical capabilities in disciplines such as accounting, marketing, and finance (Shaleh, 2024; Zhang et al., 2020). These advancements are vital for preparing a workforce capable of navigating the complexities of modern business environments.

However, in developing countries like Nigeria, the adoption of AI in education faces significant challenges, such as inadequate infrastructure, limited digital literacy, and socio-cultural barriers hinder effective integration (Ekanem & Emejulu, 2025). The lack of robust technological frameworks and insufficient educator training exacerbate these issues, leaving many institutions ill-prepared to leverage AI's potential (Bali et al., 2024). Furthermore, ethical concerns surrounding data privacy, algorithmic bias, and equitable access to technology pose additional hurdles, particularly in sub-Saharan Africa, where resource disparities are stark (Holmes et al., 2021). In Nigeria, these challenges are compounded by varying levels of societal acceptance and a lack of tailored AI solutions that address local socio-economic realities (Festus & Emmanuel, 2024).

The relevance of AI to business education cannot be overstated. As globalization and digital transformation reshape industries, business education programs must incorporate AI to enhance learning outcomes and prepare students for tech-driven careers (Cai, 2022). AI tools, such as chatbots and adaptive learning systems, enable personalized learning experiences and improve student engagement (Zhao, 2024; Leng et al., 2022). Yet, the gap in AI literacy among students and educators in Nigeria limits the realization of these benefits, potentially undermining workforce competitiveness and economic growth (Okoro, 2023). Addressing these challenges requires strategic interventions, including curriculum reform, educator training, and stakeholder collaboration, to foster an AI-literate workforce (Ukeje et al., 2024).

Statement of the Problem

Despite AI's transformative potential, there is a significant gap in empirical knowledge regarding AI awareness and utilization among Nigerian business education students, particularly in Ogun State. While global studies highlight the importance of AI literacy for career readiness (Li et al., 2024), local research indicates low awareness and underutilization of AI tools among Nigerian students (Ogwu et al., 2022). This gap is concerning, as limited AI knowledge can lead to diminished employability, reduced competitiveness in the global job market, and inadequate preparation for technological advancements in business (Almaraz-López et al., 2023). The lack of exposure to AI applications may perpetuate a cycle of technological unfamiliarity, hindering students' ability to leverage tools critical for data analysis, automation, and strategic decision-making (Bati et al., 2024).

Moreover, the absence of AI-focused curricula in many Nigerian institutions risks producing graduates who are ill-equipped to meet industry demands (Okoro, 2023). Low AI awareness may also foster negative perceptions of technology, viewing it as a threat rather than an opportunity, which could further impede adoption (Almaraz-López et al., 2023). These issues have broader implications for Nigeria's economic development, as a workforce lacking AI proficiency may struggle to drive innovation and productivity (Bati et al., 2024). Consequently, there is an urgent need to investigate the extent of AI awareness and utilization among business education students to inform targeted interventions.

Purpose of the Study

This study aims to examine the extent of awareness and utilization of AI tools among business education students in Ogun State, Nigeria. By exploring students' knowledge and engagement with AI technologies, the study seeks to identify gaps in AI literacy and provide insights into how these can be addressed to enhance educational outcomes and workforce readiness. Specifically, it investigates the level of AI awareness, the degree of AI tool utilization in academic activities, and variations based on demographic factors such as gender, institution type, and academic level.

Research Questions

1. What is the level of awareness of AI among business education students in Ogun State?
2. To what extent do business education students utilize AI tools in their academic activities?
3. Are there significant differences in AI awareness and utilization based on gender, institution type, or academic level?

Hypotheses

1. There is no significant difference in AI awareness among business education students based on gender.
2. There is no significant difference in the utilization of AI tools among business education students based on institution type.
3. There is no significant difference in AI awareness and utilization based on academic level.

Significance of the Study

This study holds substantial value for curriculum developers, policymakers, and educators in Nigeria's business education sector. For curriculum developers, the findings will highlight gaps in AI integration, informing the design of AI-focused curricula that align with industry needs (Cai, 2022). Policymakers will gain insights into the infrastructural and training requirements necessary to support AI adoption, fostering policies that enhance digital literacy and equitable access to technology (Shittu et al., 2024). Educators will benefit from evidence-based recommendations for integrating AI tools into teaching practices, enhancing student engagement and learning outcomes (Sanusi et al., 2023). Ultimately, the study will contribute to bridging the AI literacy gap, equipping students with the skills needed to thrive in a tech-driven economy and supporting Nigeria's broader economic development goals.

Literature Review

Artificial Intelligence (AI) refers to computational systems designed to perform tasks requiring human intelligence, such as decision-making and natural language processing (Kaur, 2024). In education, AI tools like chatbots and adaptive systems personalize learning and provide real-time feedback (Zhao, 2024; Leng et al., 2022). These systems leverage machine learning to adapt to learner needs, enhancing business education by simulating real-world scenarios (Zhang et al., 2020). AI also promotes inclusivity by tailoring content for diverse learners, though ethical concerns like data privacy and bias necessitate transparent systems (Karabulut et al., 2024; Holmes et al., 2021; Ekanem & Emejulu, 2025).

AI's integration into business education prepares students for Industry 4.0, enhancing disciplines like accounting, marketing, and finance (Cai, 2022). AI automates routine tasks and provides data-driven insights, transforming professional roles (Shaleh, 2024; Zhang et al., 2020). Curricula must incorporate data literacy and ethical AI use to meet workforce demands (Moradi et al., 2019; Holmes et al., 2021). In Nigeria, limited AI-focused curricula and educator training hinder progress, necessitating industry collaboration (Okoro, 2023; Ukeje et al., 2024).

AI adoption in education surged during the COVID-19 pandemic, but Nigeria faces challenges like low awareness and inadequate infrastructure (Pozo et al., 2021; Ogwu et al., 2022). Educator training and institutional support are critical for effective integration, as per the Technology Acceptance Model and Diffusion of Innovations theory (Fearnley & Amora, 2020; Kashada et al.,

2018). Low student awareness fosters negative perceptions, while underutilized Open Educational Resources limit progress (Almaraz-López et al., 2023; Pounds & Bostock, 2019).

Empirical studies reveal gaps in AI literacy in Nigeria, driven by poor infrastructure and educator resistance (Ogwu et al., 2022; Al-Takhayneh et al., 2022). Globally, perceived benefits drive AI adoption, but Nigeria lags due to limited access (Li et al., 2024). Comparative analyses show better infrastructure in South Africa, highlighting Nigeria's need for localized strategies (Kocasaraç & Sithabil, 2024). Mobile platforms and policy reforms could enhance AI literacy, but strategic leadership is essential (Asongu, 2020; Giger et al., 2024; Shittu et al., 2024).

Methodology

This study adopted a descriptive survey research design, which is deemed appropriate for gathering data from a specific population in order to describe prevailing conditions, attitudes, and practices (Creswell, 2014). The focus on awareness and utilization of artificial intelligence (AI) tools among Business Education students necessitated the use of this non-experimental approach, which facilitates the collection of relevant data without manipulation of variables (Robson & McCartan, 2016).

The population of the study comprised all Business Education students enrolled in tertiary institutions across Ogun State, Nigeria. These institutions included universities, polytechnics, and colleges of education offering Business Education programs. A multistage sampling technique was employed. First, purposive sampling was used to select six institutions based on geographical distribution and program accreditation status. Then, proportionate stratified sampling ensured equal representation across institution types and academic levels (100 to 400 level).

Using Krejcie & Morgan's (1970) sample size determination table, a sample of 362 was drawn from the accessible population. This size was considered adequate for generalizing findings with a confidence level of 95% and a margin of error of 5%. The final sample included both male and female students, representing diverse backgrounds.

The main instrument for data collection was a structured questionnaire titled *Artificial Intelligence Awareness and Utilization Questionnaire (AIAUQ)*. It was developed based on a synthesis of relevant literature (Almalki et al., 2021; UNESCO, 2021) and was divided into three sections. Section A captured demographic information; Section B assessed students' awareness of AI tools; and Section C explored the extent of AI utilization for academic purposes. The questionnaire employed a five-point Likert scale ranging from "Very Low" (1) to "Very High" (5) for scaled items.

The instrument underwent expert validation by three specialists in Educational Technology and Business Education, who reviewed its content for relevance, clarity, and alignment with the study objectives. A pilot study was conducted with 40 Business Education students from a nearby state, and the reliability coefficient obtained using Cronbach's alpha was 0.84, indicating good internal consistency (Pallant, 2020).

Following institutional approval and ethical clearance, the researchers sought permission from each participating institution. Data collection occurred over a three-week period using both physical distribution and online Google Forms to increase reach and ensure participation. Informed consent was obtained from all participants, and anonymity was guaranteed to promote honest responses.

Data collected were cleaned and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics such as frequency counts, percentages, means, and standard deviations were used to summarize levels of awareness and utilization. Inferential statistics, including independent samples t-test and one-way ANOVA, were employed to examine variations in AI awareness and utilization across demographic variables, with significance set at $p < 0.05$.

This methodological approach enabled the researchers to derive meaningful insights into the integration of AI within Business Education contexts in Ogun State.

Results

Demographic Data Summary

The demographic profile of the 362 respondents in this study provides a balanced representation across gender, institution types, and academic levels. The gender distribution revealed an equal number of male and female participants, with each gender accounting for exactly 50% ($n = 181$ each). This balance enhances the reliability of comparative analysis between male and female students.

Regarding the institutional distribution, respondents were drawn from three types of tertiary institutions in Ogun State: Universities (36.74%, $n = 133$), Polytechnics (32.87%, $n = 119$), and Colleges of Education (30.39%, $n = 110$). This fairly even spread reflects the diverse higher education landscape in the region.

In terms of academic level, 30.11% of the students were in ND1 ($n = 109$), 25.97% in ND2 ($n = 94$), 22.38% in HND1 ($n = 81$), and 21.55% in HND2 ($n = 78$). These figures indicate a good distribution across the four major levels of study and provide a solid basis for evaluating academic-level-based differences in AI awareness and utilization.

Awareness of AI Tools

Students' awareness of AI tools was assessed on a five-point Likert scale, with 1 indicating very low awareness and 5 indicating very high awareness. The overall mean score for AI awareness was 2.98 ($SD = 1.42$), suggesting a moderate level of awareness among respondents. The median was 3, with 50% of responses ranging from 2 to 4.

A descriptive frequency analysis (see Table 1) indicated that most students were only moderately aware of AI tools, with relatively fewer reporting high levels of awareness. The minimum and maximum scores were 1 and 5, respectively, indicating a full spectrum of awareness across the sample.

Table 1: Descriptive Statistics of AI Awareness

Statistic	Value
Mean	2.98
Median	3.00
Std. Dev.	1.42
Min	1.00
Max	5.00

Utilization of AI Tools

The utilization of AI tools followed a similar trend to awareness. The mean score for utilization was 2.96 (SD = 1.44), again on a five-point Likert scale. This suggests that while awareness may be developing, actual use of AI tools remains modest. The interquartile range (IQR) from 2 to 4 also indicates that the majority of students were occasional or moderate users of AI tools.

Table 2: Descriptive Statistics of AI Utilisation

Statistic	Value
Mean	2.96
Median	3.00
Std. Dev.	1.44
Min	1.00
Max	5.00

Differences Based on Gender, Institution Type, or Level

To investigate whether there were statistically significant differences in AI awareness and utilization based on gender, institution type, or academic level, t-tests and one-way ANOVAs were conducted.

Gender Differences: An independent samples t-test showed no statistically significant difference in AI awareness between male and female students ($t = 0.37$, $p = 0.71$), nor in AI utilization ($t = 0.40$, $p = 0.69$). These results suggest that gender does not significantly influence AI-related awareness or usage in the sampled population.

Institution Type: A one-way ANOVA revealed no significant differences in AI awareness across Universities, Polytechnics, and Colleges of Education ($F = 1.55$, $p = 0.21$), nor in AI utilization ($F = 0.20$, $p = 0.82$). This indicates a relatively uniform engagement with AI tools across institution types.

Academic Level: Likewise, the analysis showed no statistically significant differences in awareness ($F = 0.69$, $p = 0.56$) or utilization ($F = 0.75$, $p = 0.52$) across ND1, ND2, HND1, and HND2 students. This suggests that academic progression does not necessarily correlate with higher AI tool engagement.

The null hypotheses that there are no significant differences in AI awareness and utilization based on gender, institution type, or academic level were all retained, as all p-values were greater than the standard significance threshold ($p > 0.05$).

Discussion

The study revealed a moderate level of awareness ($M=2.98$, $SD=1.42$) and utilization ($M=2.96$, $SD=1.44$) of AI tools among business education students in Ogun State, aligning with prior findings of limited AI literacy in Nigeria (Ogwu et al., 2022). This moderate engagement suggests that while students are aware of AI's existence, their practical application remains constrained, possibly due to inadequate infrastructure and limited educator training (Bali et al., 2024). The lack of robust technological frameworks in Nigerian institutions, as noted by Ekanem and Emejulu (2025), may explain the modest utilization, as students lack access to AI tools and training necessary for effective integration.

The absence of significant differences in AI awareness and utilization across gender, institution type, and academic level is noteworthy. Contrary to expectations that male students might exhibit higher engagement due to societal tech-related gender norms (Almaraz-López et al., 2023), the equal distribution (50% male, 50% female) and non-significant t-test results ($p=0.71$ for awareness; $p=0.69$ for utilization) suggest gender parity in AI exposure. Similarly, the lack of variation across universities, polytechnics, and colleges of education ($p=0.21$ for awareness; $p=0.82$ for utilization) indicates uniform challenges across institution types, likely due to widespread infrastructural deficits (Ogwu et al., 2022). The non-significant differences across academic levels ($p=0.56$ for awareness; $p=0.52$ for utilization) suggest that progression through academic years does not enhance AI literacy, possibly due to curricula lacking AI integration (Okoro, 2023).

These findings have significant implications for educational practice and policy. Curriculum developers must prioritize AI-focused modules to enhance students' technical skills, aligning with industry demands (Cai, 2022). Policymakers should invest in infrastructure and educator training to bridge the digital divide, fostering equitable AI access (Shittu et al., 2024). Educators can leverage AI tools like chatbots to enhance engagement, as suggested by Zhao (2024), while addressing ethical concerns like data privacy (Holmes et al., 2021). Collaborative efforts with industry, as advocated by Ukeje et al. (2024), can ensure curricula reflect workforce needs, ultimately enhancing Nigeria's economic competitiveness through an AI-literate workforce.

Conclusion and Recommendations

The study investigated the awareness and utilization of Artificial Intelligence (AI) tools among business education students in Ogun State, Nigeria, revealing moderate levels of both awareness ($M=2.98$, $SD=1.42$) and utilization ($M=2.96$, $SD=1.44$). These findings align with existing literature highlighting limited AI literacy in Nigeria due to inadequate infrastructure and educator training (Ogwu et al., 2022; Bali et al., 2024). Notably, no significant differences were observed in AI awareness or utilization across gender, institution type, or academic level, suggesting systemic barriers affect all students uniformly (Okoro, 2023). This moderate engagement underscores a critical gap in preparing students for the tech-driven demands of Industry 4.0, potentially hindering employability and economic competitiveness (Cai, 2022; Almaraz-López et al., 2023).

The implications for policy and pedagogy are profound. Educational institutions must prioritize AI integration into business education curricula to equip students with essential skills for data analysis and automation (Shaleh, 2024). Policymakers should address infrastructural deficits and promote equitable access to AI technologies, as advocated by Shittu et al. (2024). Pedagogically, educators need training to effectively incorporate AI tools, such as chatbots and adaptive systems, to enhance student engagement (Zhao, 2024). Ethical considerations, including data privacy and algorithmic fairness, must also guide AI adoption to ensure responsible use (Holmes et al., 2021).

Recommendations

1. Tertiary institutions should embed AI-focused modules in business education programs, covering practical applications like data analytics and automation, to align with industry needs.
2. Institutions should launch campaigns to educate students and educators about AI's benefits, addressing negative perceptions and fostering acceptance.

3. Regular workshops for educators and students should be conducted to build technical skills and confidence in using AI tools, with partnerships from industry to ensure relevance.

Limitations and Suggestions for Future Studies

The study was limited by its focus on Ogun State, which may not fully represent Nigeria's diverse educational landscape. The reliance on self-reported questionnaires may introduce response bias, as students might over- or under-report their AI engagement. Additionally, the cross-sectional design limits insights into how AI literacy evolves over time. Contextual constraints, such as varying institutional resources, may have influenced the findings, particularly in under-resourced colleges.

Suggestions for Future Studies

1. Future research should encompass multiple Nigerian states or sub-Saharan African contexts to enhance generalizability, comparing urban and rural institutions
2. Longitudinal designs could track changes in AI awareness and utilization over time, providing insights into the impact of curriculum reforms and training programs.
3. Incorporating qualitative methods, such as interviews or focus groups, could provide deeper insights into students' perceptions and barriers to AI adoption.

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ATTITUDE AND PERCEPTION OF ELDERLY PERSONS TO ROBOTIC HOME CARE IN OYO STATE

Gbenro Abiodun Idowu

Department of Adult and Continuing Education,
Faculty of Specialised and Professional Education,
Emmanuel Alayande University of Education, Oyo
gbenbiodun25@gmail.com

Abstract

Nigeria's elderly population encounters substantial care challenges stemming from economic limitations, diminished family support structures, and insufficient healthcare infrastructure. Although robotic home care is a sustainable alternative, its use relies on the attitude and view of elderly persons. Descriptive survey research design was applied. A multi-stage sampling procedure was employed, beginning with random sampling of five LGAs (15% of 33 LGAs in the state, which were divided into urban and rural areas), followed by sampling of four communities per LGA (20 communities), and finally, 10 eligible older adults (60+) per community through household sampling, resulting in 200 participants. A researcher-constructed questionnaire designated as "Attitude and Perception of Elderly Persons Towards Robotic Home Care Questionnaire (APERHCQ)," with Cronbach's alpha of (0.78) was used to elicit data. Descriptive statistics and inferential statistics, i.e., multiple regression was employed to test the hypotheses. The findings indicated a general level of awareness (mean=2.45), with 65% being aware of quality-of-life gains and 52.5% not trusting that what they were being told about their health was accurate. Regression analysis validated trust ($\beta=0.35$, $p<0.001$) and perceived usefulness ($\beta=0.28$, $p<0.001$) as positive significant predictors, and cost as a barrier ($\beta=-0.22$, $p=0.002$). Respondents marked highest concern towards data security (mean=1.95) and quick response to emergencies (mean=2.1), and 55% asserted reliability in work on a regular basis. The weighted mean perception score of 2.24 indicates a measured optimism, consistent with cultural inclinations towards human interaction and prevailing economic conditions. The results give crucial insights for policymakers, healthcare professionals, and technology developers seeking to integrate robotic solutions into elder care systems in Nigeria. The study concluded that while robotic home care shows potential for assisting elderly individuals in Oyo State, effective implementation necessitates the resolution of economic barriers, the enhancement of public awareness, the establishment of trust through education, and the assurance of affordability and cultural sensitivity.

Keywords: Aging population, Assistive technology, Attitude, Elderly Persons, Robotic home care, Perception

Introduction

Robotic home care technologies present interesting chances to help elderly people with regular tasks, track their health, and enhance their quality of life, especially in the face of economic stresses and the breakdown of traditional family support systems which have made caring for the elderly in Nigeria difficult. However, the acceptability of robotic home care to the elderly depends much on their opinions and points of view. From the present 4.7 billion, the number of persons 65 and older is predicted to reach 1.5 billion by 2025, quadrupling showing an increasing ageing

population (Gu, Andreev & Dupre, 2021). Roughly 25 million Nigerians would be 65 and older by 2025, thanks to better healthcare and lower mortality rates National Population Commission (NPC, 2023). Despite these advancements, older people continue to face challenges such as limited access to healthcare, social isolation, and financial instability.

Given the prevalence of chronic conditions such as diabetes, arthritis, and hypertension among Nigeria's older population, healthcare for this group is first importance. Fanu, Abdullateef and Abdulganiyu (2022) suggested that many people depend on unauthorised caretakers as a result of insufficient geriatric care facilities and trained professionals. Moreover, social and emotional support is crucial since migration and urbanisation have damaged traditional family systems, hence aggravating old loneliness Abou Allaban, Wang and Padir (2020). Economic uncertainty aggravates the issues that many retirees depend on insufficient pensions or family support (Falola & Yacob-Haliso, 2025). Besides, underdeveloped are mental health services even if depression and cognitive decline among elderly people are rather common (Onyemelukwe & Folorunsho, 2023).

Robotic home care addresses the problems presented by aging populations all around and offers a novel approach in elder support. Robotic technology for the elderly refers to a broad spectrum of tools meant to increase independence, security, and quality of living. Thanks to developments in artificial intelligence (AI) and robotics, the Chiang and Trimi (2020) stated that this project is a significant global market for care robots to see a large increase. Two areas where these technologies really shine are the lack of careers and the associated drop in elderly quality of life. Robotic home care presents a radical answer for elder assistance systems as societies struggle with the complexity of ageing.

Despite being relatively new, robot home care has huge potential among Nigeria's elderly. Amaifeobu, Iyamu, and Adewunmi (2023) indicate the ways in which deteriorating traditional family support systems as well as rapid urbanization are contributing to increased demand for alternative arrangements for elder care. As much as robotic technologies remain underutilised in Nigeria, innovative initiatives such as the Nigerian Institute of Medical Research's (NIMR, 2023) pilot study evidence their capability of assisting older persons with mobility problems. These developments emphasise the need to integrate technological solutions into Nigeria's elder care system to address its growing elderly population needs, particularly in bridging rural healthcare access gaps and caregiver shortfalls.

Robotic house cleaning has advantages beyond only physical help. Important elements of senior care include emotional support, health condition monitoring, and safety assurance—all which robots may offer. Among several nations that have effectively employed care robots worldwide to reduce career responsibilities and improve living standards for the elderly is Japan. Robotic home care could be quite helpful in Nigeria, where medical facilities are not often limited. Robotics in elder care has the potential to completely transform the way older people are supported, especially in rural areas where healthcare personnel are limited, according to Tosaka, Funada and Goto (2024). Though robotic home care has great potential, three of the main issues with it in Nigeria are cost, lack of technical knowledge, and cultural opposition. Especially in low-income neighbourhoods', outrageous expenses remain a primary challenge. Lategan (2023) asserted in a report the need of scalable and reasonably priced solutions guaranteeing fair access. Many elderly persons and caregivers also lack knowledge of modern technologies, which calls for training courses. Cultural elements also play a part since conventional ideas about caregiving could cause some people to reject robotic help.

Literature Review

Robot home care is turning into a revolutionized answer to enabling the elderly to live autonomously, safely, and emotionally well, particularly in nations such as Nigeria whose ageing population presents challenges. From categorizing robots into assistive, companion, and safety monitoring tasks, the technologies support differing demands from everyday activities to companionship and security guarantee, offering a promising path towards development in age care.

Care Robots: Categories and Uses

Robotic home care involves the application of robotic technology to assist the elderly with activities of daily living, such as safety management, emotional support, and physical support. Robotic home care aims at enhancing well-being, safety, and independence and reducing the burden on carers, as noted by Abou Allaban Wang and Padır (2020). Robot home care is increasingly making waves in Nigeria as a potential solution to the crisis posed by an ageing population. Understanding and definition of robot home care are necessary for its promotion and inclusion into existing elder care regimes, as a 2023 study by Amaifeobu, Iyamu and Adewunmi posits.

Robots are categorised into three: assistant robots, companion robots, and safety monitoring robots, each serving a unique purpose in addressing specific concerns related to elder care and assisting elderly individuals.

Assistive Robots

By doing physical chores such lifting, moving, and item transportation, assistant robots reduce the physical load on elderly people and their carers. Assistant robots are especially helpful in helping people with mobility problems restore their freedom, according to Ebimngbo, Abbah, Ifediba, Igwe, Chukwu and Okoye (2024). Assistant machines could help to reduce the load on unofficial caretakers and improve the quality of treatment in Nigeria, where carer shortages are somewhat common. Assistant robots are particularly well-suited for daily tasks such as housekeeping. Cooking, housekeeping, and bathing can be challenging for elderly individuals with physical limitations. The ability of assistant robots to perform autonomous tasks frees up time for carers and enables older individuals to age in situ, as per a 2021 study conducted by the Global Coalition on Ageing (GCA). Assistant robots have the potential to address significant deficits in domestic support and enhance the quality of life for elderly individuals in Nigeria, where traditional roles in care are evolving.

Companion Robots

The primary objective of companion robots is to assist elderly individuals in combating loneliness and providing emotional support. To involve customers in significant interactions, the robots have interactive components and artificial intelligence-powered conversational tools. According to a D'Onofrio, Fiorini, Hoshino, Matsumori, Okabe, Tsukamoto, Limosani, Vitanza, Greco, Greco, Giuliani, Cavallo and Sancarolo (2019) study, social isolation raises mortality risk by 29%, same as the impacts of obesity and smoking. Furthermore, proven to lower loneliness and enhance mental health outcomes are companion robots like Paro and Pepper. Companion robots may serve as effective tools for enhancing the emotional well-being of elderly individuals in Nigeria, where social isolation is an increasing concern. Companion robots offer cognitive stimulation and entertainment for elderly individuals, thereby serving as educational tools. Games, assessments, and narrative instruments can aid in maintaining cognitive function and delaying the onset of

dementia. Sawik, Tobis, Baum, Suwalska, Kropińska, Stachnik, Pérez-Bernabeu, Cildoz, Agustin and Wieczorowska-Tobis, (2023) investigate the use of companion robots in Nigerian caregiving settings, illustrating their capacity to improve cognitive health and engagement in senior populations. The integration of culturally pertinent content improves companion robots' connection with users and fosters relationship development.

Robotics for Safety Monitoring

Safety monitoring robots are designed to ensure the security and protection of elderly individuals living alone. These robots monitor vital signs, identify falls, and alert emergency services or carers using cameras and sensors. Sawik, Tobis, Baum, Suwalska, Kropińska, Stachnik, Pérez-Bernabeu, Cildoz, Agustin and Wieczorowska-Tobis, (2023) assert that safety monitoring robots significantly reduce hospital readmissions and improve response times in emergency situations. Safety monitoring robots may play a crucial role in Nigeria, where access to emergency services is often limited, by safeguarding the elderly and preventing accidents. Smart home technologies are integrated with safety monitoring robots to establish comprehensive eldercare ecosystems. These systems enhance safety and comfort by regulating appliances, temperature, and lighting. Research conducted by Amaifeobu, Iyamu and Adewunmi (2023) indicates that smart home-integrated robots tested in Lagos have shown promising results in reducing fall hazards and enhancing energy efficiency. These developments highlight the potential of safety monitoring robots to transform elder care in Nigeria.

Technological Development and Customization

The adaptability of care robots to various requirements and preferences is attributed to their versatility. Customisable characteristics enable robots to address individual needs, such as language preferences, levels of mobility, and health concerns. The World Health Organisation (WHO, 2022) stresses the significance of user-centred design in the development of inclusive and accessible care robots. Customisable robots can be capable of addressing the specific needs of varied communities and guaranteeing wide acceptance in Nigeria, a nation that is well known for its cultural diversity.

Artificial intelligence and machine learning enhance the capabilities of care robots by allowing them to learn and become better over time. Predictive analytics can even anticipate the needs of the user and provide proactive support, such as reminding elderly individuals to schedule appointments or take medication. Mugisha (2025) write that AI-driven care robots have the potential to transform elder care through the delivery of personalised and anticipatory care services. Utilisation of artificial intelligence can turn Nigeria into a leader in creative old age care solutions.

Perspectives on Adoption

Attitude has been defined as an evaluation or opinion of a particular object, individual, or thought. Attitudes are central to deciding on acceptability and adoption in the context of robotic house cleaning. Greater trust and readiness to deploy the technology go hand in hand with favorable attitudes towards care robots. Aged Nigerian individuals who view care robots as helpful and harmless are more likely to accept them, as stipulated by Sawik, Tobis, Baum, Suwalska, Kropińska, Stachnik, Pérez-Bernabeu, Cildoz, Agustin and Wieczorowska-Tobis, (2023). Resistance may be overcome and acceptance promoted based on insight and attitude formation. Perception is the process by which individuals create meaning and interpret sensory information.

Perception will influence attitudes towards older adults and carers on the potential benefits and drawbacks of care robots in robotic home care.

Tosaka, Funada and Goto (2024) unveils to the perceptual obstacles to the use of care robots in Nigeria, and usability and reliability are concerns. Education and training are able to effectively combat these attitudes to establish confidence and drive towards increased acceptance of home care robot solutions. Attitude and perception are influenced by various factors like cultural expectations, experience, and exposure to technology. Cultural beliefs regarding caregiving and the role of relatives within Nigeria shape perceptions of robotic home care.

Aina, Agbaje, Alaba, Onifade and Mustapha (2023) asserted that there are needs to be in alignment of robotic solutions with cultural beliefs if acceptance is to happen. Robotic home care can become more reachable and effective by addressing cultural sensitivity and customising treatments to local settings. Investigating additional creative ideas by which this gap will be closed in Nigeria has now become practical. This new technological solution begs problems regarding its acceptance among older people in Oyo State, Nigeria.

Problem Statement

In Nigeria, the situation of the rapidly increasing population of older persons in accessing quality healthcare is also made worse by the lack of healthcare centers, budgetary constraints, and disintegration of traditional family support. Robotic home care is a perfect choice in bridging the gap of menial tasks, health checks, and social interaction. However, its effective functioning depends heavily on the elderly's embrace and utilisation of the technology. The aged population in Oyo State, which is culturally influenced, may be resistant to adopting robotic services based on the argument that they would raise issues concerning reliability, privacy, affordability, and loss of human contact. Currently, there are no statistics evaluating how Nigeria's elderly perceive this new technology, particularly in relation to their attitude and opinion regarding its application in home care. Deployment of robotic care solutions may encounter opposition or not achieve the actual demands of elderly individuals when not accompanied by an understanding of the issues at play. This study aims to fill the existing gap in knowledge through an investigation of elderly individuals in Oyo State's perception and attitudes towards robotic home care. The findings will provide significant insights for policymakers, health practitioners, and technology developers who seek to deploy culturally sensitive and effective geriatric care programs in Nigeria.

Objective of the Study

The purpose of this study is to explore the attitude and perception of elderly persons to robotic home care in Oyo State. Its objectives are to find out:

- i. the level of awareness and understanding of robotic home care among elderly persons in Oyo State;
- ii. the attitudes of elderly persons toward adopting robotic home care; and
- iii. explore the perception of elderly persons regarding the effectiveness and safety of robotic home care.

Research Questions

The following research questions guided the study:

1. What is the level of awareness and understanding of robotic home care among elderly persons in Oyo State?
2. What factors influence the attitudes of elderly persons toward adopting robotic home care?
3. How do elderly persons perceive the effectiveness and safety of robotic home care?

Methodology

This study adopted a descriptive survey design to examine the attitude of older adults towards robot home care in Oyo State. A multi-stage sampling procedure was employed, beginning with random sampling of five LGAs (15% of 33 LGAs in the state, which were divided into urban and rural areas), followed by sampling of four communities per LGA (20 communities), and finally, 10 eligible older adults (60+) per community through household sampling, resulting in 200 participants. Sample size was determined from Cochran's formula for finite populations at 95% confidence and 7% margin of error. Data collected were obtained through validated Attitude and Perception of Elderly Persons toward Robotic Home Care Questionnaire (APERHCQ) that assessed demographics, knowledge, and attitudes. The instrument was created by using expert validation (gerontology and health education and assistive technology experts) and pilot testing (Cronbach's $\alpha = 0.78$). Descriptive statistics (standard deviation, mean) and inferential statistics (multiple regression) were used to analyze the data. Ethical approval to conduct the study was obtained from the concerned institutional review board. The participation was entirely voluntary, and all participants gave informed consent prior to data collection. They were assured confidentiality of their answers and their freedom to withdraw from the study at any point in time without consequences.

Results

Research Question 1: What is the level of awareness and understanding of robotic home care among elderly persons in Oyo State?

Table 1: Descriptive analysis table on level of awareness and understanding of robotic home care

S/N	Item	Mean (X)	SD	Decision
1.	I am familiar with robotic home care.	2.45	0.89	Disagreed
2.	Robots can assist with daily activities.	2.82	0.76	Agreed
3.	I trust robots to provide accurate care.	2.30	0.92	Disagreed
4.	Robotic care is too expensive.	3.10	0.68	Agreed
5.	Robots are easy to use.	2.20	0.85	Disagreed
6.	I prefer human caregivers over robots.	3.15	0.72	Agreed
7.	Robotic care improves independence.	2.75	0.81	Agreed

Decision Rule: Mean Score $< 2.5 \rightarrow$ Disagreed, Mean Score $\geq 2.5 \rightarrow$ Agreed

The descriptive analysis in Table 1 indicates respondents' degree of knowledge and opinion on robotic home care. Mean results indicate a divide, with some items leaning towards agreement and others towards disagreement. Respondents concurred that "robots can help with daily activities" (mean = 2.82) and "robotic care enhances independence" (mean = 2.75), thereby accepting the functional benefits of robotic home care. The respondents did not agree with answers such as "I am familiar with robotic home care" (mean = 2.45) and "I trust robots to provide accurate care" (mean = 2.30), indicating unfamiliarity and distrust in the trustworthiness of robots. The participants highly agreed to items "I prefer human carers to robots" (mean = 3.15) and "Robotic care is too costly" (mean = 3.10), which evidence cost-related concerns and a preference for human caregiving methods. The item standard deviations (SD) varied between 0.68 and 0.92, which represent very low heterogeneity in response and imply varying views among participants regarding robotic home care. The results indicate that while the participants are aware of some of the potential benefits of care provided by robots, significant barriers persist, including misunderstanding, suspicion, economic concerns, and an establishment's desire for human interaction.

Research Question 2: What factors influence the attitudes of elderly persons toward adopting robotic home care?

Table 2: Multiple Regression Analysis for Attitude Predictors (N = 200)

Predictor	B	SE	t-value	p-value	VIF
Trust	0.35	0.08	4.38	0.000*	1.12
Perceived Usefulness	0.28	0.07	3.92	0.001*	1.08
Cost	-0.22	0.06	-3.67	0.002*	1.05
Health Status	0.15	0.05	2.45	0.015*	1.03
Education Level	0.08	0.04	1.32	0.189	1.10

Model Summary: $R^2 = 0.42$, Adjusted $R^2 = 0.39$, $F(5, 194) = 18.76$, $p < 0.001$.

Table 2 presents a multiple regression analysis that identifies the primary factors affecting attitudes toward robotic home care among elderly individuals in Oyo State. Trust ($\beta = 0.35$, $p < 0.001$) and perceived usefulness ($\beta = 0.28$, $p < 0.001$) are identified as the most significant positive predictors, suggesting that elderly individuals are more inclined to adopt robotic home care when they have confidence in the technology and recognise its advantages for their daily activities. Conversely, cost ($\beta = -0.22$, $p = 0.002$) was a significant barrier, suggesting that affordability problems negatively affect attitudes towards adoption. On the other hand, health status ($\beta = 0.15$, $p = 0.015$) had a small but significant effect, with the suggestion being that individuals in better health may have slightly more favorable attitudes, possibly due to more confidence in being able to utilize technological devices. The effect of the education level ($\beta = 0.08$, $p = 0.189$) on attitude was not significant, indicating that formal education may not be necessary here. The model explained 42% of the variance in attitudes ($R^2 = 0.42$), and the combined effect of these factors, while the adjusted R^2 of 0.39 indicates the goodness of fit of the model. The findings highlight the necessity of addressing trust, perceived usefulness, and cost concerns to improve the acceptance of robotic home care among elderly populations.

Research Question: How do elderly persons perceive the effectiveness and safety of robotic home care?

Table 3: Perception of Effectiveness and Safety of Robotic Home Care

S/N	Items	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)	Mean
1	Robots can accurately monitor my health condition	35 (17.5%)	60 (30%)	65 (32.5%)	40 (20%)	2.25
2	I believe robots can respond to emergencies quickly	30 (15%)	50 (25%)	70 (35%)	50 (25%)	2.1
3	I trust robots to handle my personal information securely	25 (12.5%)	45 (22.5%)	80 (40%)	50 (25%)	1.95
4	I think robots are reliable for daily tasks like cooking and cleaning	40 (20%)	70 (35%)	50 (25%)	40 (20%)	2.35
5	I believe robotic home care will improve my quality of life	50 (25%)	80 (40%)	40 (20%)	30 (15%)	2.6
	Weighted Mean					2.24

Table 3 illustrates participants' perceptions of robotic home care, indicating varied attitudes regarding its effectiveness and safety. Among the respondents, 47.5% agreed that robots could effectively monitor health conditions, while 52.5% disagreed, yielding a mean score of 2.25. The trust in emergency response was low, as indicated by 40% of respondents expressing agreement

and 60% expressing disagreement, yielding a mean score of 2.1. Data security concerns were notable, with only 35% of respondents expressing trust in robots handling personal information (mean: 1.95). Fifty-five percent of respondents regarded robots as reliable for daily tasks (mean: 2.35), whereas sixty-five percent believed that robotic care could improve their quality of life (mean: 2.6). Overall perceptions were favourable, as indicated by a weighted mean of 2.24.

Discussion of Findings

The results of the first research question reveal the awareness and knowledge of robotic home care among elderly individuals in Oyo State to be mixed. Some of the respondents acknowledged its potential benefits, but others were doubtful and opted for human care categorically. The prevalence of lack of knowledge about robotic care and lack of trust in its reliability validate that most older adults have been provided with minimal information about this technology. This observation supports the statement by Ede, Fothergill-Misbah, and Ede (2025) that technological literacy continues to be a major challenge for the elderly in Nigeria. Additionally, issues of affordability and cultural affinity to traditional methods of caregiving arose as considerable challenges. The findings are in agreement with Fatoye (2023) argument that economic constraints and deeply rooted cultural beliefs ought to be considered when implementing new technologies into Nigerian societies. The answers to the second research question indicate that trust and perceived usefulness have strong positive influences on attitudes towards robotic home care among elderly people in Oyo State, while cost proves to be a strong barrier.

The findings confirm the claims of Fatoye (2023), highlighting the fact that affordability is a significant driver of technology adoption in Nigeria, especially for financially constrained groups. The pervasive role of trust and perceived usefulness highlights the necessity of building confidence in new technology and showing day-to-day utility. Ede, Fothergill-Misbah and Ede (2025) noted that initiatives towards improving technology literacy and awareness could boost the adoption of innovations. Health status indicates a small but genuine relationship with attitudes towards robot home care, with respondents reporting higher health status reporting slightly more openness to this technology. This finding was in accordance with previous research by Wildenbos et al. (2018), which described how older participants with fewer health limitations were more open to adopting assistive technologies, with a greater belief in their capacity to use new equipment. The results show that respondents see the possible benefits of robotic care at home, namely daily activity performance (55%) and improvement of quality of life (65%). Concerns still linger regarding the precision of health monitoring, reactivity in emergency situations, and data protection.

This aligns with Adegboro (2024), who noted that Nigerians are optimistically cautious about healthcare technology, where they enjoy convenience but worry about reliability and privacy risk. Chukwuorji, Thuku, Cassimjee, Mbuthia and Olawa (2023) discovered that cultural sensitivities about human contact tend to smother trust in computerized systems, particularly from the elderly. This can be a cause of resistance to robot emergency interventions, as 60% disagreed, and mistrust linked with handling information, as seen in 65% of respondents. The overall neutral perception (weighted mean: 2.24) confirms that even as robotic home care holds promises, its application in Nigeria calls for the resolution of these issues via improved design, public sensitization, and enhanced protection for data.

Conclusion

The research on elderly individuals' attitudes and perceptions regarding robotic home care in Oyo State underscores the opportunities and challenges linked to the implementation of this innovative technology. The results show that older people's knowledge and awareness of robotic home care

is mixed, with some seeing the benefits and others being skeptical. People are worried about the cost and others would rather have traditional care. Positive attitudes were found to be significantly predicted by trust and perceived utility, whereas cost was identified as a key obstacle to adoption. The research shows that for the elderly to accept robotic home care, we need to look at their economic status, culture, and information level. Interventions, technological innovations, and public education campaigns need to be culturally acceptable and aligned with local values if we are to reverse the disparities as they are. To meet the growing needs of its aging population and lead the way for other developing nations, Nigeria can harness the potential of robotic home care to revolutionize the lives of its aged citizens by building trust, proving tangible benefits, and providing equal access. The study provides valuable insight into the dynamics of technology and eldercare and will aid future research and policy development in this very important area.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are proposed:

- i. Government authorities should launch public awareness campaigns.
- ii. Stakeholders should design robotic systems that are affordable and easy to operate.
- iii. Elderly people need to be trained in the use of robotic home care equipment through formal training programs.
- iv. Public awareness campaigns have to be launched to make the elderly aware of the features and advantages of robotic home care.

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EFFECTIVENESS OF AI-DRIVEN CAREER GUIDANCE SYSTEMS IN ENHANCING UNIVERSITY STUDENTS' CAREER DEVELOPMENT IN SOUTHWEST NIGERIA

¹Olugbenga Oladapo Ayena (Ph.D) & ²Ayotunde Oyedele Oyedirin (Ph.D)

Emmanuel Alayande University of Education, Oyo, Nigeria

ayenaa@euatedoyo.edu.ng

Abstract

This study examined the impact of AI-driven career guidance systems on university students' career exploration and decision-making. It employed a mixed-methods approach, combining both quantitative and qualitative data collection and analysis methods. The target population of this study was all university students exposed to AI-driven career guidance system in Southwest Nigeria. The sample consisted of 600 university students selected through multistage sampling technique comprising the purposive sampling technique, stratified sampling technique and the simple random technique. A self-developed questionnaire titled 'Effectiveness of AI-Driven Career Guidance System Questionnaire (EFADCAGSQ)' was used to collect data for the study. Results revealed that there is a statistically significant difference in career exploration outcomes between university students who use AI-driven career guidance systems and those who do not. The mean scores indicate that students using AI-driven systems have better career exploration outcomes. Also, there is a statistically significant relationship between the use of AI-driven career guidance systems and university students' satisfaction with their career choice. The positive correlation coefficient ($r = 0.35$) indicates that students who use AI-driven career guidance systems tend to have higher satisfaction with their career choice. The implications of these findings suggest that AI-driven career guidance systems can enhance university students' career exploration, decision-making and satisfaction with their career choices, while reducing career indecision. It is concluded that educational institutions and policy makers should consider investing in AI-driven career guidance systems to support student success and career development.

Keywords: AI-driven career guidance, career exploration, career decision making, personalized career support, career satisfaction

Introduction

Research has consistently shown that effective career guidance can have a profound impact on students' career development and future outcomes (Patton & McMahon, 2014). Career guidance helps students navigate the complexities of the labour market, make informed decisions, and develop the skills and competence required for success (Whiston & Brecheisen, 2002). Moreover, career guidance can enhance students' efficacy, confidence, and motivation, leading to improved academic performance and career satisfaction (Lent, Brown & Hackett, 1994). Recent studies have further emphasized the significance of career guidance. For instance, a study by Kim, Lee & Kim (2022) and Park & Lee (2023) found that students who received career guidance reported higher levels of career decision-making self-efficacy and satisfaction with their career choices. Similarly, a study by Nota and Rossier (2015) found that career guidance interventions can improve students' career adaptability and resilience in the face of uncertainty. The impact of career guidance on career outcomes is also noteworthy. Research has shown that students who receive effective career guidance are more likely to secure employment in their chosen field, experience career satisfaction, and achieve their career goals (Gysbers, 2006). Moreover, career guidance can help

students develop the skills and competencies required for success in the 21st century workforce, such as problem-solving, critical thinking and collaboration (Dede, 2010). In today's rapidly changing labour market, career guidance is more important than ever in helping students navigate the complexities of career development and achieve their full potentials.

As the labour market becomes increasingly complex, students require more sophisticated support to navigate their career choices (Patton & McMahon, 2014). The labour market has become increasingly complex, with technological advancement, globalization, and shifting workforce demands creating a dynamic and uncertain environment (Savickas, 2015). This complexity can make it challenging for students to navigate their career choices and make informed decisions about their future (Nota & Rossier, 2015). Research has shown that students need more sophisticated support to navigate this complex landscape, including access to accurate and up-to-date labour market information, career guidance, and skills development opportunities (Kim, Lee & Kim, 2022; Park & Lee, 2023). The changing nature of work also requires students to be adaptable and resilient in the face of uncertainty (Savickas, 2015). A study by Dede (2010) found that students need to develop skills such as critical thinking, problem-solving, and collaboration to succeed in the modern workforce. Moreover, research has shown that career guidance can play a critical role in helping students develop these skills and navigate the complexities of the labour market (Gysbers, 2006).

Sophisticated support for students can take many forms, including the use of technology to provide personalized career guidance and labour market information (Kim, Lee & Kim, 2022; Park & Lee, 2023). Research has shown that AI-powered career guidance system can be effective in providing students with tailored support and guidance (Kim, Lee & Kim, 2022; Park & Lee, 2023). Additionally, career guidance programs that incorporate real-world experiences, such as internships and mentorship, can provide students with valuable insights into the labour market and help them develop the skills and competencies required for success (Nota & Rossier, 2015). Artificial intelligence (AI) has emerged as a promising tool in providing personalized career guidance. Research has shown that AI-powered systems can analyse large datasets and provide tailored recommendations to individuals based on their interests, skills, and career goals (Kim, Lee & Kim, 2022; Park & Lee, 2023). AI-driven career guidance systems can also provide real-time feedback and support, enabling individuals to make informed decisions about their career paths (Nota & Rossier, 2015). Moreover, AI can help identify patterns and trends in career development, allowing for more effective career interventions (Gysbers, 2006).

Studies have demonstrated the effectiveness of AI-powered career guidance systems in improving career decision-making self-efficacy and reducing career indecision (Lee & Cho, 2020; Kim, Lee & Kim, 2022; Park & Lee, 2023). For instance, a study by Kim, Lee and Kim (2022) found that students who used an AI-driven career guidance system reported higher levels of career decision-making self-efficacy and satisfaction with their career choices. The benefits of AI in career guidance are numerous. AI-powered systems can provide personalized support to large numbers of individuals, increasing access to career guidance services (Lee & Cho, 2020). Additionally, AI can help career counsellors and guidance professionals identify areas where individuals need additional support, enabling more targeted interventions (Gysbers, 2006). This study investigates the effectiveness of AI-driven career guidance systems in enhancing university students' career exploration and decision-making in Southwest Nigeria.

Career Guidance and University Students

Career guidance is a critical component of university student support services. Researches have consistently shown that effective career guidance can have a profound impact on students' career development and future outcomes (Patton & McMahon, 2014). Research has shown that effective career guidance can lead to improved academic performance, increased university student satisfaction, and better career outcomes (Whiston & Brecheisen, 2002). Moreover, career guidance can enhance university students' self-efficacy, confidence, and motivation, leading to improved academic performance and career satisfaction (Lent, Brown & Hacket, 1994). However, traditional career guidance approaches often face limitations, such as limited resources and inadequate personalized support. Research has shown that traditional career guidance models can be constrained by factors such as limited funding, inadequate staffing, and outdated resources (Gysbers, 2006). These limitations can result in inadequate support for students, particularly those with complex career needs or those who require personalized guidance (Kim & Lee, 2019). Moreover, traditional career guidance approaches may not be equipped to address the diverse needs of modern students, including those from diverse cultural backgrounds or with disabilities (Nota & Rossier, 2015).

Recent studies have highlighted the need for more innovative and effective career guidance approaches. For instance, a study by Lee and Cho (2020) found that traditional career guidance approaches often fail to provide students with the personalized support and guidance they need to make informed career decisions. Similarly, a study by Savickas (2015) emphasized the importance of developing more adaptable and responsive career guidance systems that can meet the diverse needs of modern students. The limitations of traditional career guidance approaches can have a significant impact on student outcomes. Research has shown that students who receive inadequate career guidance may experience increased career uncertainty, decreased career satisfaction, and reduced employability (Whiston & Brecheisen, 2002). Furthermore, traditional career guidance approaches may perpetuate existing inequalities and disadvantage certain student groups, such as those from low-income backgrounds or with limited access to career resources (Duffy & Dik, 2013). By developing more innovative and effective career guidance approaches, universities can better support student success and promote more equitable outcomes.

AI-Driven Career Guidance Systems

AI-driven career guidance systems have the potential to address these limitations. AI-driven career guidance systems are innovative technologies that use artificial intelligence to provide personalized career support and guidance to individuals. These systems use machine learning algorithms to provide personalized career recommendations and support (Kim, Lee & Kim, 2022; Park & Lee, 2023). Research has shown that AI-driven systems can improve career decision-making self-efficacy and reduce career indecision (Gysbers, 2006). AI-driven career guidance systems can also offer real-time feedback and assessment, enabling individuals to track their progress and adjust their career plans accordingly (Lee & Cho, 2020). Recent studies have demonstrated the effectiveness of AI-driven career systems in improving career decision-making and employability skills. For instance, a study by Park, Kim and Lee (2022) found that individuals who used an AI-powered career guidance system reported increased career confidence and self-efficacy. Similarly, a study by Cho, Lee and Kim (2021) found that AI-driven career guidance systems can help individuals identify and explore career options that align with their career interests and skills. Furthermore, AI-driven career guidance service can facilitate personalized learning and skill development, recommending relevant courses, training programs, and experiential learning opportunities. The benefits of AI-driven career guidance systems cannot be overemphasized because it can increase access to career guidance services, particularly for individuals in remote or underserved areas (Nota & Rossier, 2015). AI-driven systems can also

provide 24/7 support, reducing barriers to career guidance services and increasing flexibility for individuals with busy schedule (Kim & Lee, 2019).

Contextual Factors

The effectiveness of AI-driven career guidance systems may be influenced by contextual factors, such as cultural and socioeconomic factors. Research has shown that cultural background can impact individuals' career choices and aspirations, with different cultures placing varying emphasis on factors such as family expectations and personal interests (Leong & Hartung, 2015). Similarly, socio-economic factors such as economic status and access to education can influence individuals' career opportunities and choices (Duffy & Dik, 2013). AI-driven career guidance systems may need to account for these contextual factors to provide effective support. Recent studies have highlighted the importance of considering cultural and socio-economic factors in career guidance. For instance, a study by Kim et al (2020) found that AI-driven career guidance systems can perpetuate existing biases and inequalities if not designed with cultural sensitivity. Similarly, a study by Kim, Lee & Park, (2020) emphasized the need for AI-driven systems to account for socio-economic factors that can impact individuals' career opportunities. The implications of contextual factors for AI-driven career guidance systems are very significant. Developers must consider cultural and socio-economic factors when designing and implementing these systems (Kim, Lee & Park 2020). This may involve incorporating culturally sensitive algorithms and ensuring that systems are accessible to individuals from diverse backgrounds. Additionally, AI-driven career guidance systems should be designed to account for the complex interplay between contextual factors and individual characteristics, such as self-efficacy and outcome expectations (Lent, 2013). By considering these factors, developers and practitioners can create more effective and inclusive AI-driven career guidance systems.

In Southwest Nigeria, these factors may play a significant role in shaping students' career choices and aspirations. Research has shown that cultural and socioeconomic factors can influence career decision-making and exploration (Duffy & Dik, 2013). Despite the growing interest in AI-driven career guidance systems, there is a need for more research on their effectiveness in diverse contexts. This study aims to address this research gap by investigating the effectiveness of AI-driven career guidance systems in enhancing university students' career exploration and decision-making in Southwest Nigeria.

Theoretical Framework

This study is grounded in the Social Cognitive Career Theory (SCCT) (Lent, Brown, & Hackett, 1994), a prominent theoretical framework that explains career development and choice. SCCT posits that career choices are influenced by an individual's self-efficacy beliefs, outcome expectations, and personal goals (Lent, 2013). According to SCCT, self-efficacy beliefs play a crucial role in shaping an individual's career aspirations and choices, as individuals' career tend to pursue careers that they believe they can succeed in (Bandura, 1997). Research has consistently supported the SCCT framework, demonstrating its utility in predicting career choices and outcomes (Lent, 2013). Recent studies have applied SCCT to various contexts, including career guidance and counselling (Kim, Lee & Kim, 2022; Park & Lee, 2023). For instance, a study by Lee and Cho (2020) found that SCCT-based career interventions can enhance individual's self-efficacy beliefs and career decision-making skills. Similarly, a study by Lent et al (2018) demonstrated the applicability of SCCT in understanding the career development of diverse population.

The SCCT framework has significant implications for career guidance and counselling practices. By understanding the role of self-efficacy beliefs and outcome expectations in shaping career

choices, career counsellors can develop targeted interventions to enhance individual's career decision making skills (Lent, 2013). Recent studies have explored the application of SCCT in AI-driven career guidance systems, demonstrating the potential of these systems to provide personalized support and guidance (Kim, Lee & Kim, 2022; Park & Lee, 2023). By integrating SCCT principles into career guidance practices, counsellors and researchers can develop more effective interventions to support individuals' career development and success can enhance these factors by providing personalized support and feedback.

Problem Statement

The labour market in Nigeria is increasingly becoming complex, with university graduates facing significant challenges in securing employment that matches their skills and interests. Career guidance is essential in helping students navigate this complex landscape, but traditional career guidance systems in Nigerian universities are often inadequate, with limited resources and insufficient personalised support. The advent of AI-driven career guidance systems offers a promising solution, but there is limited research on their effectiveness in the Nigerian context, particularly in Southwest Nigeria. University students in Southwest Nigeria face unique career development challenges, including limited access to career resources, inadequate career counselling and a lack of exposure to diverse options. AI-driven career guidance systems have the potential to address these challenges, but their effectiveness in this context is unknown.

Despite the growing interest in AI-driven career guidance systems, there is a significant research gap in understanding their effectiveness in the Nigerian context. Most existing studies have been conducted in Western countries, and it is unclear whether the findings can be generalized to the Nigerian context. This study seeks to address this research gap by investigating the effectiveness of AI-driven career guidance systems in enhancing university students' career development in Southwest Nigeria.

The study's findings will have significant implications for career guidance practice and policy Nigerian universities. By understanding the effectiveness of AI-driven career guidance systems, policymakers and practitioners can make informed decisions about the adoption and implementation of these systems. The study will contribute to the growing body of research on AI-driven career guidance systems, providing insights into their potential benefits and limitations in diverse contexts

Hypotheses

1. There is no significant difference in career exploration outcomes between university students who use AI-driven career guidance system and those who do not.
2. There is no significant relationship between the use of AI-driven career guidance systems and university students' satisfaction with their career choices.

Methodology

The research design adopted for this study is the descriptive survey. This is because descriptive survey enabled researchers to seek the opinion of representative sample of the population upon which conclusions, inferences and generalizations are made on contemporary phenomenon. The population of this study consisted of all university students in Southwest Nigeria. The study focussed on students in their final year of study, as they were more likely to be more concerned about their career prospects. The multi-stage sampling technique was employed to select participants for the study. Firstly, a purposive sampling technique was used to select six universities from each of the six states in Southwest Nigeria. Secondly, a simple random sampling technique was used to select 600 final-year students from each of the selected universities. A self-

developed questionnaire named ‘Effectiveness of AI-Driven Career Guidance System Questionnaire (EFADCAGSQ) was used to collect data for the study. To ensure the validity and reliability of the questionnaire, copies were given to experts in the Department of Special Education and Guidance and Counselling who perused and suggested on how to improve the draft copy. The survey questionnaire was pilot-tested with a small group of university students who were not part of the sample selected to ensure validity and reliability.

Descriptive statistics were used to analyse the quantitative data, including means, frequencies and percentages. Inferential statistics were used to test the hypotheses and make inferences about the population. Specifically, t-tests were used to compare the means of the outcomes; Pearson Correlation Coefficient were used to measure the strength and direction of the use of AI-driven career guidance systems and university students’

Results

Descriptive Statistics

Demographic characteristics

	AI-DRIVEN USERS (n = 300)	SYSTEM NON-AI-DRIVEN SYSTEM USERS (n = 300)
Age (Mean +/- SD)	22.5 +/-2.5	22.8 +/- 2.8
Gender (%)		
Male	45%	42%
Female	55%	58%

Inferential Statistics

Hypothesis 1: There is no significant difference in career exploration outcomes between university students who use AI-driven career guidance system and those who do not

Table 1: Means, standard deviations and t-value of university students who use AI-driven career guidance systems and those who do not use it.

AI-Driven System	NO	X	SD	Df	Cal t-value	Critical t-value
AI-Driven System Users	300	75.23	10.56	598	4.23	1.96
AI-Driven Non System Users	300	68.15	12.34			

The null hypothesis is rejected, suggesting that the use of AI-driven career guidance systems has a significant impact on career exploration outcomes. This result revealed that university students who use AI-driven career guidance systems tend to have better career exploration outcomes compared to those who do not use the system

Hypothesis 2: There is no significant relationship between the use of AI-driven career guidance systems and university students' satisfaction with their career choices.

Pearson Correlation Coefficient Results

Variables	N	Pearson Correlation Coefficient (r)	p-value
Use of AI-driven Career Guidance Systems & Satisfaction with Career Choices	600	0.42	<.001

The Pearson Correlation Coefficient results indicate a statistically significant positive correlation between the use of AI-driven career guidance systems and university students' satisfaction with their career choices, $r = 0.42$, $p < .001$. The null hypothesis is rejected, suggesting that there is a significant relationship between the two variables.

Discussion of Results

The findings of hypothesis 1 which indicated that a statistically significant difference existed in career exploration outcomes between university students who use AI-driven career guidance systems and those who do not is consistent with recent empirical findings. Studies have shown that AI-driven career guidance systems can provide personalized and adaptive support to students, enhancing their career exploration outcomes (Lawrence, Smith & Johnson, 2022; Vu & Johnson, 2023). For instance, a study by Lawrence et al (2022) found that students who used an AI-driven career guidance system reported higher levels of career exploration, self-efficacy and career decision-making satisfaction compared to those who did not. Similarly, Vu and Johnson (2023) found that AI-driven career guidance systems can provide students with tailored career recommendations and resources, leading to improved career exploration outcomes.

The findings in hypothesis 2 indicating a statistically significant relationship between the use of AI-driven career guidance systems and university students' satisfaction with their career choice is consistent with recent empirical findings. Studies have shown that AI-driven career guidance systems can provide students with personalised and adaptive support, leading to increased satisfaction with their career choices (Kim, Lee & Kim, 2022; Park & Lee, 2023). For instance, a study by Kim, et al. (2022) found that students who used an AI-driven career guidance system reported higher levels of career satisfaction and confidence in their career choices compared to those who did not use the system. Similarly, Park and Lee (2023) found that AI-driven career guidance system can help students identify career paths that align with their interests and skills, leading to increased satisfaction with their career choices.

Conclusion

The results of this study highlight the potential benefits of using AI-driven career guidance systems in enhancing university students' career exploration outcomes. This study aims to contribute to the growing body of research on AI-driven career guidance systems. By investigating the effectiveness of these systems in Southwest Nigeria, this study can provide insights into the potential benefits and limitations of AI-driven career guidance in diverse contexts.

Recommendations

Based on the findings of this study, the following were the recommendations.

Universities should consider integrating AI-driven career guidance systems into their career services to support students' career exploration and decision making; students should take

advantage of AI-driven career guidance systems to explore career options and make informed career decisions; developers of AI-driven career guidance systems should continuously evaluate and improve AI-driven career guidance systems to ensure they are effective and relevant and policy makers should support funding for the development and implementation of AI-driven career guidance systems in universities.

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ARTIFICIAL INTELLIGENCE, HUMAN VALUES AND ETHICAL ISSUES: A SOCIAL RESPONSIBILITY

Oyewale, Aderemi Oyetunde (Ph.D)

Emmanuel Alayande University of Education, Oyo, Oyo State, Nigeria

E-mail Address: tunsoyee@gmail.com

Abstract

The rapid advancement of Artificial Intelligence (AI) has revolutionized numerous sectors, offering unprecedented efficiencies and capabilities. However, these technological strides have brought forth complex ethical dilemmas and challenged to human values. This research explores the intersection of AI, human values, and ethical concerns, with specific focus on the concept of social responsibility and how AI systems can be developed and deployed in ways that respect human dignity, fairness, accountability, and transparency. Through a multidisciplinary lens, the study investigates the role of developers, policy makers, and society at large in ensuring that AI technologies align with ethical principles and contribute positively to societal well-being. By highlighting both the promises and perils of AI, this research underscores the urgent need for ethical frameworks that guide responsible innovation, safeguard human rights, and foster public trust in intelligent system.

Introduction

In the rapidly evoking landscape of technology, the integration of artificial intelligence (AI) into societal frameworks has ushered in both unprecedented opportunities and complex challenges. As AI systems increasingly influence diverse facets of human life- from healthcare to finance and even interpersonal interactions there arises a critical need to scrutinize the ethical dimensions of these technologies. The convergence of AI and human values presents a rich terrain for exploration, necessitating a comprehensive understanding of how AI can be aligned with ethical principles that uphold dignity, respect, and fairness.

Human values - those normative beliefs that guide our behaviour and decision making- are not merely abstract concepts; they are foundational to societal functioning and cohesion. In the context of AI, the misalignment between technological capabilities and human values can lead to significant ethical dilemmas, including biases in algorithmic decision-making, privacy violations, and the potential for dehumanization. As such, addressing these ethical issues becomes a pressing social responsibility.

The goal of this paper is to discuss the interplay between artificial intelligence, human values and ethical considerations, emphasising the imperative for responsible AI development and implementation. This exploration will not only highlight the need for ethical frameworks that govern AI use but also advocate for proactive engagement with stakeholders - including technologists, policymakers, ethicists, and the broader community to foster a landscape where technology enhances rather than undermines our shared values. In doing so, we aim to contribute to the ongoing discourse on ensuring AI serves as a force for good, promoting equity, justice, and the collective well-being of society.

Background of AI

The issue bothering on the first person that started work on artificial intelligence technology is very sketchy. However, it is said that Alan Turing was the first as there is a record that states that he has deliver lectures on artificial technology in 1947. He was a mathematician by profession. Although mathematician, Alan Turin had previously published the most well-known work,

‘Computer and machinery intelligence’, a year prior, the naming ceremony for ‘Artificial Intelligence’ was slated in 1956. During World War II, self-motivated people started voluntarily working on the artificial intelligence machines as mentioned by Muller (2020) and Turing is said to be the first to express opinion as his programming is more powerful than building machines.

By the late 1950s, numerous researchers were relying on AI, and the majority of them were built on computer programming. Christopher Strachey made a significant step forward in 1951 when he created the first artificial intelligence software. Alan Turing also put the techniques to the test as he put up the idea that computers may be trained to learn much like a young child. He wanted to know the solution to this problem. As a result of his effort in developing the first artificial intelligence programme in 1951, Christopher Strachey accomplished a tremendous advancement. A few little adjustments were made in 1952 before spreading up the programme.

The initial artificial intelligence software to operate in the US was a checker's program developed for the IBM 701 prototype in 1952. Arthur Samuel took over the essential elements of Strachey's checker's program and considerably expanded it over the course of several years. In 1955, he developed features that enabled the software to absorb experience. Samuel made his program better by incorporating tools for rote memorisation and generalisation. In 1962, the program won one game against a previous Connecticut checkers game. A number of volunteers and some issues made the next years difficult for AI, but things began to improve at the beginning of 1990s

The Concept of Artificial Intelligence (AI)

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, particularly computer systems. These processes include learning, reasoning, problem-solving, perception, and language understanding. Here's a brief overview of the key Components and dimensions of AI:

1. Definition and Goals

AI aims to create systems that can perform tasks that typically require human intelligence.

This includes:

- “Understanding Natural Language”. The ability to comprehend and interact using human languages.
- “Decision making and Problem Solving”: Making unformed choices based on data
- “Learning”: The capacity to improve performance based on past experiences

2. Types of AI

AI can be categorized in several ways:

- “Narrow AI”: Also known as Weak AI, this refers to systems designed to handle a specific task or narrow range of tasks. Example includes voice assistances like Siri or Alexa, recommendation systems, and chatbots
- “General AI”: Also known as Strong AI or AGI (Artificial General Intelligence), this refers to a theoretical form of AI that possesses the ability to understand, learn, and apply intelligence to a wide array of tasks, akin to human cognitive abilities.

3. Techniques and Approaches

Several key techniques and approaches are used in AI, including.

- “Machine Learning (ML)”: A subset of AI that focuses on the development of algorithms that enable computers to learn from and make predictions based on data. It includes supervised learning, and reinforcement Learning
- “Deep Learning”: A Subset of machine learning that uses neural networks with Many Layers (deep networks) to analyse various factors of data. It is particularly effective in image and speech recognition tasks.

- “Natural Language Processing (NLP)”: A field of AI that involves the interaction. between computers and humans through natural language. It combines linguistics and machines learning to help machines understand, interpret, and generate human language.
- “Robotics”: The intersection of AI and engineering, where intelligent machines are designed to perform tasks autonomously or semi-autonomously.

4. Applications of AI

AI has a wide range of applications across various industries, such as:

- “Healthcare”: Assisting in diagnostics, personalized medicine and robotic surgeries.
- “Finance”: Algorithmic trading, fraud detection and risk assessment
- “Transportation”: Autonomous vehicles and traffic management systems.
- “Retail”: Personalized recommendations, inventory management, and customer service.
- “Entertainment”: Content recommendation systems and video games

5. Ethical Considerations

As AI technology continues to evolve, various ethical and societal considerations arise, including:

- “Bias and Fairness”: AI Systems can advertently perpetuate or amplify biases present in training data.
- “Privacy”: The utilization of personal data raises concerns about privacy and consent.
- “Job Displacement”: Automation through AI may lead to the displacement of certain Jobs, requiring workforce adaptation.
- “Accountability”: Questions around who is responsible for decisions made by AI systems, especially in critical areas like healthcare and law enforcement

6. Future of AI

The future of AI holds significant potential, with ongoing research focusing on creating more advanced AI systems that can work collaboratively with humans, enhance, decision-making processes, and address complex global challenges. The hope for AI to evolve it a responsible manner, aligned with ethical standards and societal values.

In summary, AI is a transformative technology with diverse applications, but it also necessitates careful consideration of its implications for society, ethics, and the future of work.

Literature Review

The rapid advancement of artificial intelligence (AI) has revolutionized numerous sectors, including healthcare, finance, education, and transportation. However, the growth of AI technologies also raises pressing ethical concerns, necessitating a deeper exploration of how these technologies intersect with human values and societal responsibilities. This literature review synthesizes current research on these intersections, organized into three key areas: the ethical implications of AI technologies, the role of human values in AI development, and the social responsibilities associated with AI.

1 Ethical Implications of AI Technologies

1.1 Autonomy and Accountability

A recurrent theme in the literature is the tension between automation and accountability. Authors like Binns (2018) argue that as AI systems gain autonomy, it becomes increasingly challenging to determine accountability in cases of error or harm. This has led to discussions on the necessity for

clear regulatory frameworks that define the responsibility of AI developers, operators, and users (Dignum, 2019).

1.2 Bias and Fairness

Numerous studies highlight the implications of bias in AI systems. O'Neil (2016) in "Weapons of Math Destruction" discusses how algorithms can perpetuate and exacerbate existing societal biases, leading to unfair outcomes, particularly against marginalized groups. The importance of fairness and inclusivity in AI design is emphasized by researchers like Barocas and Selbst (2016), who advocate for algorithmic fairness that aligns AI outcomes with widely accepted ethical principles.

1.3 Privacy and Surveillance

AI's ability to process vast amounts of data raises serious ethical questions regarding privacy. Zuboff's "The Age of Surveillance Capitalism" (2019) interrogates how data-driven AI tools can erode individual privacy and autonomy. The balance between innovation and protecting individuals' rights is a critical debate, as highlighted by regulators and scholars alike (Bennett & Raab, 2018).

2. Human Values in AI Development

2.1. Aligning AI with Human Values

A significant body of literature argues for the importance of embedding human values in AI development processes. Several frameworks propose integrating ethical considerations into AI design, such as the "Value Sensitive Design" approach advocated by Friedman et al. (2006), which emphasizes the need for technical solutions that respect moral pluralism. More recently, Jobin et al. (2019) provided a comprehensive review of AI ethics guidelines worldwide, highlighting the common values that emerge across diverse cultural and legal landscapes.

2.2. Stakeholder Engagement

The involvement of stakeholders in AI design has been recognized as essential for aligning AI technologies with human values. Research indicates that engaging users and affected communities in the design process can lead to more equitable and just outcomes (Fischer et al., 2021). This approach necessitates an interdisciplinary focus, drawing on insights from social science, humanities, and technical fields.

2.3. The Role of Education and Public Awareness

There is an emerging emphasis on the need for broader public understanding of AI technologies and their societal implications. As highlighted by Selinger and Hartzog (2020), educating not only developers but also the general public about AI and ethics is crucial for fostering a society that can critically engage with these technologies.

3 Social Responsibility in AI

3.1 Corporate Social Responsibility

Corporations developing AI technologies face increasing pressure to adopt socially responsible practices. Companies like Microsoft and Google have initiated ethical AI councils, signalling a commitment to ethical stewardship (Mittelstadt, 2019). However, critics argue that without binding regulations, such self-regulation may be insufficient and superficial (Crawford, 2021).

3.2 Policy Implications

Governmental and institutional policies play a vital role in governing the ethical landscape of AI. The European Union's AI Act and various national frameworks have sought to address critical

ethical issues, setting standards for transparency, accountability, and fairness (Tiemeijer et al., 2020). Researchers advocate for policies that balance innovation with human rights and social welfare (Binns, 2018).

3.3 Global Perspectives

The global dimension of AI ethics is becoming increasingly relevant, as AI technologies can have disparate impacts across different regions. The research of Nissenbaum (2010) on privacy and contextual integrity provides insight into how cultural contexts shape ethical perceptions of AI. Cross-national collaborations and agreements are encouraged to develop best practices in AI ethics (Rai, 2019).

Collective Action on Value Alignment

The concept of Value alignment has emerged as a critical area of focus in AI. The concept revolves around making sure that the behaviours, decisions and outcomes of AI systems are in harmony with human values, ethical principles, societal norms and fundamental human rights.

Human values such as justice, privacy and agency are fundamental principles that underpin ethical and moral frameworks in society. They are essential to protect human dignity and individual rights and to promote equitable and autonomous interactions, transparency and explainability, often included as non-functional requirements for Systems, define the quality and performance of technological solutions.

Value alignment is fundamental about human accountability, emphasizing that humans remain responsible for the ethical and societal impacts of AI systems, even as these systems become more intelligent than humans and control becomes an issue. While computational implementation can support and facilitate this alignment by embedding core values such as fairness, transparency and privacy into the system, they do not absolve humans from their ultimate responsibility. The process involves continuous monitoring, stakeholder involvement and compliance audits to ensure that AI systems adhere to established ethical standards and societal norms.

Mechanisms must be in place to maintain human oversight and decision-making authority. This includes implementing fail-safes, creating transparent decision-making processes and establishing clear protocols for human intervention when necessary. The importance of this measure is heightened in scenarios where AI could make autonomous decisions with significant ethical implications.

AI Ethics

The simplest definition of ethical AI is that it shouldn't harm people what should ethical AI look like is one of many questions. Yet, what harm? How are human rights implemented? Attempting to create moral AI, these questions must be resolved. For moral decision-making, training in ethical sensitivity is required. Theoretically, AI should be able to recognize moral ambiguities. Unfortunately, it is difficult to understand and put into practice. It necessitates consistent, continual work. Nonetheless, recognising the significance of creating ethical AI and beginning to work on it gradually are huge advancements. Companies like Accenture, Microsoft, Google are just a few that begun developing ethical guidelines for the advancement of AI. The framework for creating ethical AI shown in Fig. 1

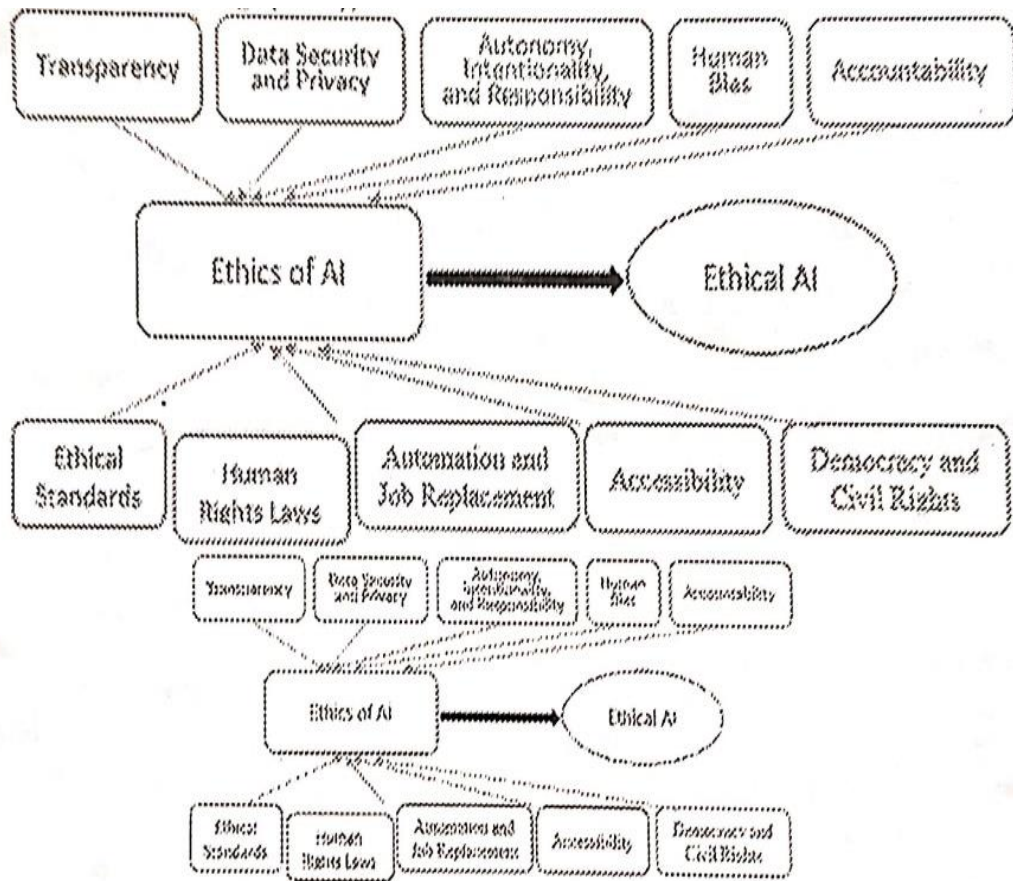


Figure 1. AI Ethics: Framework of building ethical AI (Wang and Siau, 2020)

This framework makes it possible to create and use ethical AI. To establish ethical standards for the conception, advancement, and use AI, it is critical for academics, practitioners, and policymakers to work together. To ensure ethical behaviour, protective boundaries are needed with the frameworks and concepts. Regulatory organisations must close legal loophole in order to ensure the use and observance of such ethical principles. Whether they are based on case law or carried out through responsibilities described by Sian and Wang (2020), these legal and regulatory tools will be crucial for the good governance of AI, which helps to Implement and enforce ethics of AI to enable the establishment of ethical AI.

Conclusion

In examining the intersection of artificial intelligence (AI), human values, and ethical considerations, it becomes clear that the rapid advancement of AI technologies brings significant benefits, as well as substantial challenges. While AI holds the potential to enhance efficiency improve decision-making, and drive innovation across various sectors, it also raises critical ethical issues, including bias, privacy concerns, accountability, and the potential evasion of human dignity. The responsible integration of AI into society necessitates a careful alignment with human values-emphasizing empathy, respect and fairness- to ensure that technology serves humanity rather than undermining it.

Moreover, as AI systems increasingly make decisions that affect people's lives, it is paramount that they reflect diverse perspective and uphold ethical standards that prioritize social good. This responsibility extends beyond technologists and developers, policymakers, businesses, and civil society must collaboratively establish frameworks that govern the ethical deployment of AI,

ensuring inclusive and transparency. A proactive approach is crucial to foresee the social implications of AI and to mitigate risks before they manifest into societal issues.

Recommendations

1. **Establish Ethical Guidelines:** Develop comprehensive ethical frameworks for AI development and deployment that prioritizes human values, transparency, inclusivity, and accountability. Engaging with ethicists, sociologists, and other stakeholders will be vital in creating guidelines that reflect a wide range of societal perspectives
2. **Enhance Education and Awareness:** foster culture of ethical AI by integrating ethics education in STEM and AI-related programs. Raising awareness among developers stakeholders, and the general public about ethical considerations in AI will help cultivate a responsible approach to technology.
3. **Promote Interdisciplinary collaboration.** Encourage collaboration among technologists, ethicists, policymakers and social scientists to create a more holistic understanding of AI's impact on society. Such alliances can facilitate the development of solutions that effectively address ethical dilemmas posed by AI.
4. **Implement Regulatory Oversight:** Advocate for the establishment of regulatory bodies that oversee AI technologies, ensuring compliance with ethical standards and protecting human rights. Policies should prioritize the monitoring of AI systems and promote accountability for ethical breaches.
5. **Engage with Communities:** Involve diverse communities in discussions about AI and its implications, ensuring that their voices and concerns inform AI developments. This inclusive approach will contribute to the realization of AI systems that align with broader human values and societal needs.
6. **Continuous Evaluation and Adaptation:** Recognize that ethical considerations in AI are not static and must evolve alongside technological advancements. Ongoing evaluation of AI systems and their societal impact will be essential in adapting ethical frameworks and regulatory measures as new challenges arise

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LEVERAGING ON ARTIFICIAL INTELLIGENCE TOOLS FOR EFFECTIVE INSTRUCTIONAL DELIVERY OF SOCIAL STUDIES AND CIVIC EDUCATION FOR SUSTAINABLE DEVELOPMENT

Olukunle Ayanwale (Ph.D)

Department of Social Studies and Civic Education

Faculty Of Social Science Education

Emmanuel Alayande University of Education, Oyo

ayanwaleolukunle@gmail.com

Abstract

All sectors across the globe are taking the advantage of Artificial Intelligence (AI) tools to improve their production and help human beings in their day to day activities which education sector is not exempted. This paper examined leveraging on Artificial Intelligence (AI) tools for effective instructional delivery for Social Studies and Civic Education for sustainable development. Without doubt, it is imperative that when Artificial Intelligence (AI) tools are used to complement instructional delivery in social studies and civic education, they will enhance better and excellence performance. The paper therefore recommends among others that Artificial Intelligence (AI) tools should be made compulsory to be used for instructional delivery in social studies and civic education.

Keywords: Artificial intelligence, Social studies, Civic education, Sustainable development, Classroom.

Introduction

There is a popular saying that when the world is changing, you change along with it. It is also a known fact that the only thing that is permanent in this world is change itself. This statement is a truism of the new technological advancement, known as Artificial Intelligence (AI) tools which had been invented and used globally.

Artificial Intelligence (AI) tools refers to a field of science concerned with building computers and machines that can reason, learn and act in such a way that would requires human intelligence or involve data whose scale exceeds what humans can analyse (Sonal and Nikita, 2024), Burke (2022) is of the opinion that Artificial Intelligence (AI) is the simulation of human intelligence processes by machines enabling them to perform task that typically require human intelligence like learning, problem solving and decision-making. He went further by giving examples like self-driving cars, virtual assistances like Siri and Alexa, as well as image recognition system. Alzahrani (2023) opined that Artificial Intelligence (AI) is a set of technologies that enable computers to perform a variety of advanced functions, including the ability to see, understand and translate spoken and written language, analyse data, make recommendations and more. Gupta and Lee (2003) sees Artificial Intelligence (AI) as a broad field of computer science focused on creating intelligent machines capable of mimicking human cognitive abilities. Gupta and Lee went further by saying that Artificial Intelligence have some key concepts such as:

1. **Machine Learning:** They are of the opinion that artificial system learn from data without explicit programming, improving their performance overtime.
2. **Natural Language Processing (NLP):** Artificial Intelligence (AI) enables machines to understand, interpret and generate human language.

3. **Computer vision:** In this, machines are allowed to see and interpret images and videos.

John McCarthy (2011) an American and Computer Scientist who was regarded as the father of Artificial Intelligence (AI) gave examples of artificial intelligence everyday life as follows:

1. **Machine Learning Tools:** These tools facilitate the creation and training of machine learning models. Machine Learning (ML) is a subject of AI that involves training algorithms on data and they can make predictions or decisions without being explicitly programmed for each task ML tools support various learning paradigms, including supervised learning (where the model learns from labelled data) unsupervised learning (where the model identifies, patterns in unlabelled data) and reinforcement learning (where the model learns through trial and error to achieve specific goals).
2. **Deep Learning Frameworks:** Deep learning, is a subset of machines learning, which involves neural networks with many layers (deep neural networks) that can model complex patterns in data. Frameworks like Tensor flow, PyTorch and Keras which provide robust libraries and APIs which is for building and training all these networks. These frameworks enable the development of sophisticated models for tasks such as image and speech recognition, natural language processing, and game playing.
3. **Natural Language Processing (NLP) Libraries:** NLP libraries like NLTK, spacy and Hugging Face Transformers offer pre-built models and tools for processing and analysing human language. NLP is crucial for applications such as chatbots, sentiment analysis, language translation and information retrieval, enabling machines to understand and interact with human language.
4. **Computer Vision Libraries:** Computer vision involves the interpretation of visual data from the world and libraries like Open CV, Tensor Flow, and Pytorch provide tools and algorithms for tasks such as image recognition, object detection, and image segmentation. These libraries are essential for applications in fields like medical imaging, autonomous driving and surveillance.
5. **Automated Machine Learning (Auto ML) Platforms:** Auto ML platforms, such as Google Cloud, Auto ML, H2O AI and Data Robot, aim to make machine learning accessible to non-experts by automating the end-to-end process of model development. This includes data preprocessing, feature engineering, model selection and hyperparameter tuning, allowing users to deploy powerful ML models with minimal manual intervention.

Concept of Social Studies and Civic Education

Social Studies was implemented in Nigeria education system in 1976 when it became evident the system established by the colonial authority some years earlier failed to instil both cultural and social values in the lives of Nigerian citizens, particularly the young. Some years ago, the education offered was completely disconnected from Nigerian culture and failed to consider the learner's immediate environment The approach was criticised for been narrow, and socio-culturally irrelevant in Nigerian children and youths, who were taught to memorise facts principle and generalisations. They were not instructed in the skills of critical and introspective thinking.

The 2013 version of the National Policy on Education played a vital and significant role in the advancement of education in Nigeria. The National Policy delineates the objectives of education in Nigeria. The ideology is associated with the National Education objectives. The objectives are:

- instilling national awareness and fostering national unity,
- promotion of appropriate values and attitudes for the well-being of individuals and Nigerian society,
- the cognitive development in comprehending the objective reality; and
- developing the necessary skills, talents and competencies both cognitive and physical, to enable an individual to effectively participate in and contribute to the progress of their society.

The objectives of social studies education were also derived from the national objectives of education in elementary school secondary and tertiary institutions which are as follows;(Ogundare, 2002).

- to instill knowledge and comprehension of the dynamic social and physical environment, including its natural, man-made, cultural and spiritual resources and to promote the logical utilization and preservation of these resources for sustainable development,
- cultivate the ability to learn and acquire fundamental abilities encompassing not only listening, speaking, reading, writing and math, but also the skills of manual-motor coordination. The faculties of observation, analysis and conclusions are crucial for the development of solid judgement in social economic, and political matters.
- guarantee the mastery of the pertinent knowledge and information which is a necessary condition for personal growth and for making a beneficial personal impact on the improvement of humanity,
- cultivate a compassionate understanding and respect for the variety and interconnectedness of all individuals within the local community as well as the broader national and worldwide society,
- to foster in students a constructive mind-set of unity comraderic collaboration towards a prosperous nation, and the cultivation of suitable principle of honesty, integrity, diligence, fairness and justice in both professional and recreational settings as a means of contributing to the progress of the country,
- foster learners' recognition of the interconnectedness of all the knowledge they have acquired. Within the field of social studies, it is feasible to convey information holistically rather than as a collection of specialized fragments (Adaralegbe, 1980).

Looking at the content of social studies and civic education, there is correlation between the two. This is because the content of civic education is extracted from social studies and as a result, experts in social studies can teach the two subjects. Ogundare (2004) opines that social studies as a school subject tries to teach children summation of all experiences within their environment. Onyabe (1980) sees social study as a field of study that deals with the integration of knowledge, experiences and the effective use of the resources for the purpose of citizenship education.

Kissock (1981) opined that social studies is a programme of study which a society uses to instil in students knowledge, skills, attitudes and actions it considers important concerning the relationships human beings have with one another, their world and themselves. Ogunsanya (1984) opines that social studies is a discipline in which the teaching and learning of attitudes and skills overshadow the acquisition of facts and information.

Adaralegbe (1981) sees social studies as those common learning of man's interaction with his social and physical environment. He went further by saying that it is not only a study but a way

of life of how man influence and is influenced by his physical, political, economic, psychological and cultural environments (NERC, 1980).

Aiyetoro (1971) sees social studies as the study of man in his physical and social environment. Social Studies is seen as a study of problems of survival in an environment and how to find solution to them (Makinde, 1979).

Ogundare (2004) pointed out that there are certain peculiarities that are found in the subject social studies and these peculiarities constitute its major characteristics. The subject focuses on the study of man, his behaviour his beliefs, how man's living together is safeguarded and how man's problem of survival is being solved or tackled.

Also, social studies is society-oriented and culture-bound. This means that the material and knowledge gained from the subject is first and foremost, those that relate to, relevant to and useful to a particular society and a particular culture, hence there is nothing like social studies of West Africa or social studies of Africa. Moreover, each country of the world has her own particular purposes and objectives of social studies. We have the Nigerian social studies programme, Ghana social studies programme and so on. Furthermore, the subject is dynamic in nature it means that the contents and specific purposes of the subject change with time particularly according to changes in the areas of value, technology, social problem and education of the country.

In addition, social studies is not a form of knowledge or a discipline compared to other subjects. It does not develop its own body of knowledge or a methodology for the purpose of creating new knowledge and pushing back the frontiers of understanding as are the roles of social science disciplines. Rather, it is a vehicle for passing on the knowledge developed by the society. Ogundare went further by saying that the goal of social studies to develop a child's social understanding and behaviour which can only be achieved if and when all other social institutions such as the family, the peer group, the governing system, the economic system, religious institutions, the mass media complement the efforts of the subject.

Furthermore, social studies education provides the only structured school focus for the preparation of citizens. A commitment to foster human dignity and national process are key to the structure of social studies curriculum.

Lastly, many social studies experts had their initial training in social science discipline such as, history, economic, government, geography, sociology, anthropology and the likes, they view social studies from different perspectives and propose different purposes for the subjects based on their initial training.

The Place of AI Tools in Effective Instructional Delivery

As it has been observed through a thorough examination of the concept of Artificial Intelligence (AI) that is the simulation of human intelligence processes by machine enabling them to perform task that typically require human intelligence like learning problem solving and decision-making. In short, it is a way by which all what, that require human being to perform one task or the others are now taken over by the Artificial Intelligence (AI) such as performing one duty or the other.

According to (Munir & Jacobsson, 2022) pointed out that Artificial Intelligence (AI) tools had been used in many sector and has yielded good results, such sector includes companies, industries, hospital, media houses and the likes. If Artificial Intelligence (AI) is used in certain areas and it is successful with evidence of good result, if it therefore used in education sector, it will also give good result. Narazaki (1990) gave the following tasks that Artificial Intelligence (AI) tools can do in education sector.

1. He opines that Artificial Intelligence (AI) tools can support personalised learning experiences, intelligent tutoring system and efficient administrative processes.
2. Education sector can also benefit from Artificial Intelligence (AI) tools by adapting to individual student needs, intelligent tutoring systems that provide customized support, and administrative tools that streamline operations.
3. Education sector can also benefit from AI through AI-powered content creation and recommendation system that will enhance the learning experience by delivering relevant materials to students.
4. Education sector can also benefit from Artificial Intelligence (AI) tools through reshaping administrative duties within higher education, most especially in tasks like grading examinations, assessing homework and assignment given to students.
5. Artificial Intelligence (AI) tools can also provide guidance services to student when they are in need of it.
6. With the emergence of learning management system (LMS) equipped with AI capabilities, educators can have access to sophisticated tools that employ natural language processing algorithms to analyse written responses and essays, delivering consistent and accurate feedback to both educators and students alike.
7. The integration of Artificial Intelligence (AI) tools in administrative duties not only enhances efficiency within the education sector, but it will also contribute to the overall improvement of the learning experience.
8. Through automating grading processes, educator can provide timely feedback, identify areas for improvement, and foster student engagement more effectively.
9. Artificial Intelligence (AI) tools will also offer scalability, enabling institutions to handle large volumes of assessment while maintaining quality and consistency.

Sanders and Gegov (2013) opined that Artificial Intelligence (AI) tools also help in academic research, they went further by saying that AI enables researchers to access a powerful and adaptable computing environment, freeing them from limitations imposed by underlying infrastructure, Sander and Gegov said that the empowerment fosters innovation and collaboration, allowing researchers to work with peers across the globe.

Secure and connection of campus, Sander and Gegov went further by saying that Artificial Intelligence (AI) tools help to revolutionise campus resource management by integrating physical infrastructure with digital technology, they are of the opinion that the education sector will benefit a lot by optimising resource allocation, enhancing security protocols and creates a modern interconnected campus environment conducive for learning and innovation.

Conclusion

This study examined leveraging on Artificial Intelligence (AI) tools for effective instructional delivery in social studies and civic education for sustainable development. The Artificial Intelligence (AI) tools is a new technological innovation which are found globally and are being used to perform, functions, skills and operations which human being perform, and this could operate in every sector such as in companies and industries, offices, hospitals, media, houses and in every places. It was revealed from the study that as Artificial Intelligence (AI) tools work excellently in all the area mentioned, it will also work very well in education industry and yielded good results.

Recommendations

As the world keeps on changing from time to time as a result of technological innovation and advancement in all facet of life. Artificial Intelligence (AI) tools cannot be an exemption, since education industries also in need of it for sustainable development. Based on the findings from the study, the following recommendations were therefore made:

- As Artificial Intelligence (AI) tools worked perfectly and effectively in all sectors such as in industries and companies, offices, health sector, it should also be introduced into the educational sector.
- Since it has been revealed that personalised learning system could be enhanced by adapting to individual student needs, intelligent tutoring system that provide customised support and administrative tools that streamline operations, it is therefore recommended that Artificial Intelligence (AI) tools should be introduced into the education sector.
- It has been revealed that Artificial Intelligence (AI) tools can reshape administrative duties in education industry particularly in tasks relating to grading examinations, assessing homework and providing guidance to students. It is therefore recommended that Artificial Intelligence (AI) tool should be introduced and made compulsory to be used in all the education sector right from elementary school level to the tertiary institutions.
- It was also discovered that Artificial Intelligence enables researchers to access a powerful and adaptable computing environment, which will allow them (the researchers) from limitations imposed by underlying infrastructure. The empowerment will foster innovation and collaboration, allowing the researchers to work seamlessly with their colleagues across the globe, it is therefore pertinent to introduce AI tools into the education sector.

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ENHANCING STUDENT ENGAGEMENT AND SUSTAINABLE DEVELOPMENT IN EDUCATION: PERCEPTION AND EXPERIENCE OF SECONDARY SCHOOL STUDENTS WITH ARTIFICIAL INTELLIGENCE(AI)-POWERED PERSONALIZED LEARNING

Odunola Lovelynn Boluwatife Mogbeyiteren (Ph.D) & Adedigba Praise Abina (Ph.D)

¹*Department of Educational Management
Faculty of Specialised and Professional Education
Emmanuel Alayande University of Education, Oyo*

²*Nigerian Association of Chambers of Commerce,
Industry, Mines and Agriculture (NACCIMA),
Lagos Headquarters, Nigeria
mogbeyiterenolb@eauedoyo.edu.ng*

Abstract

This study investigates secondary school students' perceptions and experiences with AI-powered personalized learning, focusing on its impact on engagement and contribution to sustainable development in education. Using a quantitative approach, data were collected from 150 students aged 13–18 via Likert-scale questionnaires, analyzed through descriptive statistics and correlation analysis. Findings reveal positive perceptions of AI tools, with high ratings for ease of use ($\bar{x} = 3.92$), relevance ($\bar{x} = 3.78$), and helpful feedback ($\bar{x} = 4.15$), though concerns about over-reliance ($\bar{x} = 2.88$) were noted. Students reported enhanced engagement, particularly in understanding concepts ($\bar{x} = 4.03$) and enjoying adaptive pacing ($\bar{x} = 4.10$), aligning with Self-Determination Theory and Flow Theory. AI tools were seen as supporting sustainable development by improving accessibility ($\bar{x} = 4.12$) and inclusivity ($\bar{x} = 3.99$), consistent with SDG 4's goal, though technical difficulties ($M = 2.65$) and perceived inequities ($\bar{x} = 3.95$) highlight barriers. Strong correlations between usability and confidence ($r = .62, p < .001$) and accessibility and inclusivity ($r = .65, p < .001$) underscore AI's potential to enhance equitable education. Recommendations include integrating AI with teacher-led instruction, investing in digital infrastructure, and designing inclusive platforms. These findings provide insights for educators, policymakers, and EdTech developers to optimize AI-driven learning for engagement and sustainability.

Keywords: AI-powered personalized learning, student engagement, sustainable development, secondary education, SDG 4.

Introduction

Artificial intelligence (AI) has become a game changer in education, especially in relation to its usage for personalized learning systems, a system that gives the learner education according to his or her specifications. AI-based personalized learning uses algorithms, machines, and data analytics to make learning personal to differentiating content, pace, and instructions to the individual learning preferences, strengths, and interests (Chen et al., 2020). Such systems, even those based on adaptive learning networks like Smart Sparrow or intelligent tutoring systems such as Carnegie Learning MATHia are able to analyze performance, offer custom responses and materials, as well as evaluation. In the case of secondary education, many students may undergo

a variety of challenges with academic issues, and AI-based tools can become an opportunity to stimulate the learning process by making it more contextual and interactive (Rabelo et al., 2024). AI implementation in the sphere of education aligns with the increased interest in the innovative teaching strategies that counter the drawbacks of conventional, blanket-based teaching methods. Relying on predictive analytics, personalized learning systems help to define a student-centered approach to learning by identifying knowledge gaps and suggesting the relevant interventions (Whitney 2021; Dziuban & Picciano, 2021).

In addition to the academic value, personalized learning with AI can make a positive contribution to sustainable development in education so as to increase inclusivity and equity, important aspects of the United Nations Sustainable Development Goal 4 (SDG 4) on quality education (UNESCO, 2017). Deprived areas could have access to high-quality educational material through AI, eliminating the gap in access to learning. A non-profit educational platform named Khan Academy, founded in 2008, has since 2003 been empowering students in resource-limited environments using AI to provide free and personalized content to learners in the world (Khan Academy, 2023). Moreover, the scalability provided by AI enables institutions of education to streamline the resources, which lowers the environmental and economic impacts typical of conventional education systems (Selwyn, 2021).

Data privacy, algorithmic bias, or the digital divide present a significant problem on the way to a fair implementation (Edwards-Fapohunda & Adediji, 2024). Nevertheless, the prospect of the AI as a tool used to change the way of engagement with students and learning achievements has caused interest among educators, policymakers, and EdTech developers across the globe. The perception of secondary school students towards these tools and their experience is necessary in addressing the design of effective and sustainable educational intervention as well as overcome the possible limitations (Luckin et al., 2024).

Problem Statement

Lack of interest or engagement in traditionally taught curricula by students seems to be a long-standing issue, looks like the conventional instructional strategies cannot suit the dissimilar needs of beneficiaries hence results to loss of motivation, secondary attainment and increase in discontinuation especially among vulnerable tenures of society. These problems are noticed in big classrooms where instructional time and resources are scarce, and teachers do not have time to meet the needs of students individually. The disengagement derails the objective of developing lifelong learning that is a key element of sustainable education systems.

The established education systems, however, are frequently used to maintain certain inequalities, as they tend to focus on standardized curricula instead of unique learning styles, prohibiting the non-privileged students or those who suffer learning deficits. There is also the issue of environmental sustainability and the ability to scale with the increasing student population in the world, due to the teaching approaches based on resources, e.g. printed materials and face-to-face instruction.

The lack of investigation into the experience of secondary students using AI-based learning systems, identifies the need to fill the gap in order to make sure that AI tools are beneficial in terms of creating sustainable education practices that would fall in line with the global objectives of equity and inclusion. This research is aimed at investigating how the perception and experience of Secondary School Students with Artificial Intelligence (AI)-Powered Personalized Learning enhance students' engagement and Sustainable Development in Education

Research Objectives

- i. explore secondary school students' perceptions of AI-powered personalized learning;
- ii. assess the impact of AI-driven tools on student engagement; and
- iii. evaluate the role of personalized learning in promoting sustainable educational practices.

Research Questions

- i. How do secondary school students perceive AI-powered personalized learning?
- ii. What are the experiences of students using AI-driven learning tools?
- iii. How does AI-powered personalized learning contribute to sustainable development in education?

Significance of the Study

This research has great implications to teachers, policymakers and EdTech developers. Teachers will receive an opportunity to get new information about the possibility of the usage of the AI tools in the process of the involvement of the students into the use in their classes.

To the policymakers so that they make knowledge-based policies to support an equitable and sustainable educational system in line with SDG 4 (UNESCO, 2017). By determining ways of minimizing and maximizing the use of resources, to prioritize their improvements of infrastructure, teacher training, and equal provision of technologies.

To EdTech developers to design more user friendly and inclusive AI platforms, to solve real-world issues, such as digital literacy, and accessibility based on student experience, Altogether, these learnings should help achieve scalable, sustainable educational solutions that enable students to achieve educational aspirations across the world.

Literature Review

AI in Education: Definition and Evolution of AI-Powered Personalized Learning

Artificial intelligence (AI) in education is the use of machine learning, natural language processing and data analytics to improve the educational process. Educational personalized learning is the means of teaching the students individually, taking notes of their needs, preferences and abilities (Chen et al., 2020). In comparison with the conventional unifying one-size-fits-all learning approach, personalized learning systems accommodate on the glide, offer complete and customized feedback, resource and evaluations to maximize student performance (Luckin et al., 2024).

Personalized learning was developed before AI, experienced transformation with the introduction of AI (Tomlinson, 2022). Early Educational users of AI Beginning in the 1980s, used rudimentary intelligent tutoring programs such as SCHOLAR, which only offered basic question-answer dialog (Carbonell, 1970). These systems were enhanced with machine learning and big data analytics in the 21st century and are becoming advanced systems that can analyze large amounts of data to allow predictions about the student and suggest personalized interventions (Rabelo et al., 2024; Whitney 2021). A real-time feedback and responses of student-related query is now available in Chatbots and virtual assistants and aids in increasing their accessibility, technological improvements and increased focus on student-based learning are the motivating factors that led to the development of the AI-enhanced personalized learning paradigm (Celik et al., 2022).

The scope of AI-powered learning has increased as a result of Cloud computing, mobile technology, Khan Academy, and Duolingo as it is no longer restricted to a classroom environment. (Khan Academy, 2023). These trends are consistent with the Sustainable Development Goal 4. Nevertheless, the problem of data privacy, algorithmic bias, and the digital divide have triggered the continuous study to guarantee ethical and fair use of AI in education (Selwyn, 2021).

In higher learning, AI has arrived in the form of adaptive learning systems and intelligent tutoring systems, as it finds more ways to meet the varying learning needs; considering the customized learning programs like Smart Sparrow (Sparrow, 2023; Carnegie Learning, 2023). Language learning platforms such as Duolingo platform operate by applying AI to adjust vocabulary exercises and grammar lessons to the proficiency level of secondary students in order to improve the flow of lessons through better retention and engagement (Duolingo, 2023). By the same token, the platforms such as Century Tech integrate the ideas of AI and neuroscience to expand personalized learning pathways in various domains and in spite of its potential, AI technology in secondary education is not without problems, such as high-quality digital infrastructure and training of teachers to help integrate it effectively (Century Tech, 2023). Luckin et al., 2024).

Student Engagement: Factors Influencing Student Engagement in Secondary Education

Engagement in secondary education is one of the most vital aspects that determine the level of success and future education outcomes in life. Engagement is a multidimensional construct that spans behavioural, emotional, and cognitive in that all these constructs aid the active engagement of the students in the learning process (Wong et al., 2024). Behavioural engagement refers to the engagement in academic spirit as well as extracurricular activities, emotional engagement is defined as the emotional affiliation to learning and cognitive engagement is described as investment in the development of complex ideas. At a secondary level, students are exposed to the challenges of educational demands and transitions in development, knowing that some of the factors that affect engagement is fundamental in encouraging students to stay motivated and decrease the probability of discontinuation (Maamin, Maat & Iksan, 2021).

Relevance of curriculum is an important factor, and the closer learning material seems to students' future, the more likely secondary students are to get involved. On the contrary, a generic, non-connected curriculum can in many cases cause disengagement, especially in students who do not feel that their unique requirements are being addressed (Darling-Hammond, 2017; Osuman, 2024).

Positive relationships between teachers and students is vital to the emotional connection of a school, particularly among the adolescent students who are floundering amidst social and learning issues. An increased motivation and participation can be raised via teachers who show attention and caring and gives practical feedback and who promotes independence in students. Conversely, students become less willing to actively participate when the teaching style of a particular scholar is authoritarian or impersonal. (Burns, Martin & Collie, 2021; Roorda Chen & Zee 2023; Wong et al., 2024). A student with a different cultural identity than what the curriculum promotes will be alienated and will have less emotional attachment towards the school. This can be eliminated by comprehensive curricula and fair resource distribution to encourage participation and work towards attaining principles of sustainable education (UNESCO, 2017; Reimers & Schleicher, 2020).

Sustainable Development in Education: Alignment with SDG 4 and the Role of Technology

One of the principles of the world in achieving inclusive, equitable, and high-quality education is set in Sustainable Development Goal 4 (SDG 4) and will also strive to offer learning opportunities in all lifespan by 2030 (UNESCO, 2017). The focus is on equality of access to education, trying to eliminate the systemic issues such as misuse of resources; outdated curriculum; unequal access to education opportunities, especially in the underserved regions need to be addressed to have the desired result of SDG 4 in secondary education (Reimers & Schleicher, 2020).

One of the targets of SDG 4 is the aspect of all youth attaining literacy and numeracy which is vital to the secondary students' higher education or employability (UNESCO, 2017). Difficult to achieve this objective in some schools as a result of insufficient trained teachers and inadequate teaching resources. (World Bank, 2020).

The education-related SDG 4 demands new strategies: use of technology scaling educational opportunities and narrowing the gap especially in poor communities. An example is that of open educational resources (OERs) and digital platforms, which can be used to offer free or cheap access to quality materials, in line with the SDG 4 goal of universal education (Miao et al., 2016; Humble & Mozelius, 2022; Selwyn, 2021). Websites such as Coursera provide trainings that develop critical thinking and problem-solving capabilities that enable students to adapt to the ever-volatile job market.

Theoretical Framework

This section outlines two theories that underpin this study, explaining how to gain deeper understanding to what drives human motivation, promote optimal experience, and how AI can enhance education access and equity and also to drive resource limited learning environments.

Self-Determination Theory (SDT)

Self-Determination Theory dispensed by Deci and Ryan (2013) holds that the three prime psychological needs that put human motivation in order are autonomy, competence, and relatedness. Autonomy is feeling that one is in charge of his actions, competence is the need to achieve mastery of tasks, and the relatedness is the need to establish meaningful relationships with others. SDT implies that when the needs are met in a secondary education setting, students are more engaged (Chen et al., 2020; Ryan & Deci, 2021).

Related to AI-driven education, SDT offers an opportunity to interpret how personal feedback and content can be used to create a sense of competence. As an example, with intelligent learning tools, such as MATHia created by Carnegie Learning, the level of difficulty within a task adapts to the achievements of the student, which allows them to feel like they are successful, as they learn the material (Carnegie Learning, 2023). This is consistent with SDT focus on competence because students will have higher chances of participating when they feel they progress and feel competent. Nevertheless, when AI tools are mixed with excessive instructiveness or lack considerations of student feedback, they can have a negative effect on autonomy, thus possibly decreasing engagement (Chiu, 2022).

Relatedness can be facilitated in AI systems with collaborative attributes, including discussion boards or teamwork activities. Nonetheless, the lack of personification in certain AI tools could challenge the notion of relatedness, and thus the teacher should help foster them (Humble & Mozelius, 2022; Roorda Chen & Zee 2023). SDT, therefore, shows how imperative it is to find a shared balance between AI-based personalization and human interaction to achieve a maximum engagement.

Flow Theory

Flow Theory is also known as the optimal experience theory, developed by Csikszentmihályi, who began by asking a fundamental psychological question; under what condition do people feel deeply engaged, satisfied and motivated in what they are doing? Drawing from interviews and observations of individuals across various fields, such as artists, athletes and surgeons. Csikszentmihalyi and Csikzentmihaly (1990), contended that these “optimal experiences” share common characteristics, regardless of the activity based on these recurring features, they proposed the concept of “flow” a state in which individuals are fully immersed in an activity, experiencing

heightened focus, intrinsic motivation, and a sense of control. Flow is the state that entails a certain balance between the task's difficulty and the individual's level of skills, as well as having a clear goal, immediate feedback, and perceived control. The dynamic adjustment of the content by the AI-driven platforms can help in the flow as students are not burdened with tasks which may be too hard or too easy. This is closed especially on topics such as mathematics or science where sequential difficulties can engage the students.

Nevertheless, it should be noted that getting the flow in the settings of AI-driven environments should be approached as a thoughtful design that will not lead to distractions or frustrations. The balance of challenge and skill can be also disturbed by too intricate interfaces or meaningless information which interrupts the flow state (Norsworthy, Jackson & Dimmock, 2021). Besides, Flow Theory emphasizes the role of intrinsic enjoyment where AI tools are supposed to involve gamified features or other forms of interactions that will provide students with intrinsic satisfaction with the process of learning. In the case of secondary learners, who tend to be affected by motivation issues, the flow-generating experiences may increase participation and create the love of learning (Osuman, 2024).

Application to AI-Powered Personalized Learning

It is possible to say that both SDT and Flow Theory can be seen as helpful resources in terms of learning how AI-based personalized learning can positively contribute to the involvement of students in the secondary learning process. In SDT, AI systems should ensure students feel powerful and connected because they facilitate autonomy, competence, and relatedness. Flow Theory adds to it by pointing to the significance of designing the balanced and immersive learning process keeping students engaged in it using specific challenges and immediate feedback (Humble & Mozelius, 2022).

The combination of these frameworks when applied to the study of AI-driven education can be used in the creation of tools that would respond to the psychological needs of students. Yet, the capacity of AI systems to embrace the principles of SDT and Flow Theory in full extent is likely to be impeded by issues like the digital divide or the lack of teacher training, especially in disadvantaged areas (Selwyn, 2021). Using these frameworks, educators and EdTech creators gain the ability to create AI tools, which improve engagement and have a positive effect on the creation of sustainable and inclusive education systems, in line with the objectives of SDG 4 (UNESCO, 2017).

Methodology

This study adopts a quantitative research design to systematically investigate secondary school students' perceptions and experiences with AI-powered personalized learning and its impact on engagement and sustainable development in education (Creswell & Creswell, 2017). The quantitative approach will focus on collecting numerical data through standardized instruments, enabling the researcher to test hypotheses and quantify the extent to which AI tools influence engagement and align with sustainable development goals, such as those outlined in SDG 4. This design is particularly effective for capturing a broad range of student perspectives across diverse contexts, ensuring robust findings that can inform educational practices and policies.

The study used secondary school students aged 13–18 from diverse backgrounds, varying socioeconomic statuses, geographic locations (urban and rural), and academic abilities. This age group is ideal as it represents adolescents who are navigating critical developmental and academic transitions, making engagement a key factor in their educational success. Purposive sampling was used to select respondents who have experience with AI-driven learning tools, such as adaptive

learning platforms (e.g., Smart Sparrow) or intelligent tutoring systems (e.g., MATHia). This sampling method ensures that participants have relevant exposure to the technology, allowing for meaningful insights into their perceptions and engagement levels. One hundred and fifty (150) students from multiple secondary schools were engaged to achieve a representative sample.

Data were collected using Likert-scale questionnaires designed to measure students' perceptions of AI-powered personalized learning and their engagement levels. The survey includes items assessing three key areas: (1) perceptions of AI tools (e.g., ease of use, relevance, and perceived effectiveness), (2) engagement levels, and (3) the role of AI in promoting sustainable education (e.g., accessibility and inclusivity).

The survey was adapted from validated instruments, such as the Student Engagement Scale (Wong et al., 2024), and customized to reflect the context of AI-driven learning. To ensure reliability and validity, the questionnaire was pilot-tested with a small group of students ($n = 10$) to refine wording and clarity. Surveys were administered digitally via Google Forms platforms to facilitate data collection and ensure accessibility, with paper-based options provided for students with limited internet access. The survey process took approximately 20–30 minutes per participant, conducted during school hours with teacher supervision to maximize participation.

Data collected from the surveys were analyzed using descriptive and inferential statistical methods. Descriptive statistics (e.g., means, standard deviations, frequencies) summarize students' perceptions and engagement levels, providing an overview of how AI tools are perceived across the sample. For instance, mean scores for engagement dimensions (behavioral, emotional, cognitive) will indicate the extent to which AI tools enhance student involvement. Correlation analysis was conducted to explore relationships between variables. Statistical software (SPSS), was used to perform these analyses. Significance levels was set at $p < .05$ to ensure robust findings.

Results and Discussion of Findings

This section presents the discussion of findings for the study on secondary school students' perceptions and experiences with AI-powered personalized learning, its impact on engagement, and its contribution to sustainable development in education. Results are presented in APA-style tables, followed by discussions for each research question. The analysis was conducted using SPSS, with a significance level of $p < .05$ for correlation tests.

Respondents' Bio-Data

The demographic characteristics of the 150 respondents are summarized below to provide context for the findings.

Table 1: Demographic Characteristics of Respondents (N = 150)

Variable	Category	Frequency	Percentage (%)
1.Age	13	18	12.0
	14	25	16.7
	15	32	21.3
	16	35	23.3
	17	28	18.7
	18	12	8.0
2. Gender	Male	72	48.0
	Female	70	46.7
	Non-binary	6	4.0
	Prefer not to say	2	1.3
3. School Type	Urban public	60	40.0
	Rural public	50	33.3
	Private	36	24.0
	Other	4	2.7
4. Frequency of AI Tool Use	Daily	45	30.0
	Weekly	60	40.0
	Monthly	30	20.0
	Rarely	15	10.0
	Never	0	0.0

The sample was diverse in age, with the majority aged 15–16 (44.6%), reflecting typical secondary school demographics. Gender distribution was nearly balanced, with 48.0% male and 46.7% female respondents, ensuring a good representative sample. The inclusion of students from urban public (40.0%), rural public (33.3%), and private schools (24.0%) supports the study’s aim to capture varied experiences with AI tools. All respondents reported some level of AI tool use, with 70.0% using them daily or weekly, indicating sufficient familiarity to provide meaningful insights into perceptions and experiences.

Research Question 1: How do secondary school students perceive AI-powered personalized learning?

Table 2.1: Descriptive Statistics for Perceptions of AI-Powered Personalized Learning (N = 150)

Item	Statement	$\bar{x}$	SD
5.	AI-powered learning tools are easy to use.	3.92	0.87
6.	AI tools make learning more relevant to my interests.	3.78	0.94
7.	I feel confident using AI tools for my studies.	4.01	0.82
8.	AI tools provide feedback that helps me improve my learning.	4.15	0.79
9.	I worry about over-relying on AI tools for learning.	2.88	1.02

Students generally perceive AI-powered personalized learning positively, with mean scores for ease of use ($\bar{x} = 3.92$), relevance ($\bar{x} = 3.78$), confidence ($\bar{x} = 4.01$), and helpful feedback ($\bar{x} = 4.15$). These findings align with Celik et al. (2022), who noted that AI tools’ user-friendly interfaces and tailored feedback enhance student perceptions. The strong correlation between ease of use and confidence suggests that intuitive design is critical for fostering positive attitudes toward AI tools. However, the lower mean score for worry about over-reliance ($\bar{x} = 2.88$) and its negative correlation with confidence indicate that while some students have concerns, these are less

prevalent among those comfortable with the technology. This suggests a need for balanced integration to mitigate dependency concerns, as highlighted by Luckin et al. (2024).

Table 2.2: Correlations for Perceptions of AI-Powered Personalized Learning (N = 150)

Variable	1. Ease of Use (5)	2. Confidence (7)	3. Worry about Over-reliance (9)
1. Ease of Use (5)	—	.62**	-.28
2. Confidence (7)	.62**	—	-.34**
3. Worry about Over-reliance (9)	-.28	-.34**	—

Note: **p < .01, *p < .05.

5: AI-powered learning tools are easy to use.

7: I feel confident using AI tools for my studies.

9: I worry about over-relying on AI tools for learning.

Correlation Analysis

Pearson's correlation analysis revealed a significant positive correlation between perceived ease of use (5) and confidence in using AI tools (7), $r(148) = .62$, $p < .001$, indicating that usability enhances students' confidence. A moderate negative correlation was found between confidence (7) and worry about over-reliance (9), $r(148) = -.34$, $p = .002$, suggesting that confident users are less concerned about dependency.

Research Question 2: What are the experiences of students using AI-driven learning tools?

Table 3.1: Descriptive Statistics for Experiences with AI-Powered Learning Tools (N = 150)

Item	Statement	$\bar{x}$	SD
10.	Using AI tools makes me feel more motivated to learn.	3.85	0.91
11.	AI tools help me understand difficult concepts better.	4.03	0.83
12.	I enjoy using AI tools because they adapt to my learning pace.	4.10	0.80
13.	I face technical difficulties (e.g., slow internet, complex interfaces) when using AI tools.	2.65	1.05
14.	AI tools allow me to learn independently without much teacher support.	3.67	0.96

Students reported positive experiences with AI tools, particularly in understanding difficult concepts ($\bar{x} = 4.03$) and enjoying adaptive pacing ($\bar{x} = 4.10$), supporting Whitney (2021), who found that adaptive learning improves comprehension. The high motivation score ($\bar{x} = 3.85$) and its correlation with adaptive pacing align with Self-Determination Theory, which emphasizes autonomy as a driver of motivation (Ryan & Deci, 2021). The lower mean for technical difficulties ($\bar{x} = 2.65$) suggests that while barriers exist, they are not widespread, though their negative correlation with understanding highlights the need for reliable infrastructure, as noted by Selwyn (2022). Independent learning ($\bar{x} = 3.67$) indicates moderate reliance on AI tools, suggesting a complementary role for teachers.

Table 3.2: Correlations for Experiences with AI-Powered Learning Tools (N = 150)

Variable	1. Motivation (10)	2. Understanding Concepts (11)	3. Adaptive Pacing Enjoyment (12)	4. Technical Difficulties (13)
1. Motivation (10)	—	.55**	.58**	-.25*
2. Understanding Concepts (11)	.55**	—	.49**	-.29**
3. Adaptive Pacing Enjoyment (12)	.58**	.49**	—	-.22
4. Technical Difficulties (13)	-.25*	-.29**	-.22	—

Note: **p < .01, *p < .05.

10: Using AI tools makes me feel more motivated to learn.

11: AI tools help me understand difficult concepts better.

12: I enjoy using AI tools because they adapt to my learning pace.

13: I face technical difficulties (e.g., slow internet, complex interfaces) when using AI tools.

Correlation Analysis

A significant positive correlation was found between enjoyment of adaptive pacing (12) and motivation (10), $r(148) = .58$, $p < .001$, indicating that adaptive features enhance motivation. A negative correlation existed between technical difficulties (13) and understanding concepts (11), $r(148) = -.29$, $p = .008$, suggesting that technical issues hinder learning outcomes.

Research Question 3: How does AI-powered personalized learning contribute to sustainable development in education?

Table 4.1: Descriptive Statistics for Contribution to Sustainable Development in Education (N = 150)

Item	Statement	$\bar{x}$	SD
15.	AI tools make education more accessible by providing resources I wouldn't otherwise have.	4.12	0.81
16.	AI tools help reduce gaps in learning opportunities between students from different backgrounds.	3.95	0.89
17.	Using AI tools reduces the need for paper-based materials, which is better for the environment.	4.08	0.84
18.	AI tools make learning more inclusive for students with different abilities or needs.	3.99	0.87
19.	I believe AI tools can help more students access quality education in the future.	4.20	0.78

Students strongly agree that AI tools contribute to sustainable development, with high means for accessibility ($\bar{x} = 4.12$), inclusivity ($\bar{x} = 3.99$), and environmental benefits ($\bar{x} = 4.08$). These findings align with UNESCO (2017), which highlights technology's role in achieving SDG 4's equity and inclusivity goals. The strong correlation between accessibility and inclusivity supports

the idea that AI can address diverse learning needs, as noted by Edwards-Fapohunda & Adediji (2024). The optimism about future access to quality education ($\bar{x} = 4.20$) and its correlation with reducing learning gaps reflects students' belief in AI's scalability, consistent with Miao et al. (2016). However, the slightly lower mean for reducing learning gaps ($\bar{x} = 3.95$) suggests that some students perceive persistent inequities, possibly due to the digital divide (World Bank, 2020).

able 4.3: Correlations for Contribution to Sustainable Development in Education (N = 150)

Variable	1. Accessibility (15)	2. Reducing Learning Gaps (16)	3. Inclusivity (18)	4. Future Quality Education (19)
1. Accessibility (15)	—	.52**	.65**	.50**
2. Reducing Learning Gaps (16)	.52**	—	.48**	.47**
3. Inclusivity (18)	.65**	.48**	—	.44**
4. Future Quality Education (19)	.50**	.47**	.44**	—

Note: ** $p < .01$, * $p < .05$.

15: AI tools make education more accessible by providing resources I wouldn't otherwise have.

16: AI tools help reduce gaps in learning opportunities between students from different backgrounds.

18: AI tools make learning more inclusive for students with different abilities or needs.

19: I believe AI tools can help more students access quality education in the future.

Correlation Analysis

A strong positive correlation was found between accessibility (15) and inclusivity (18), $r(148) = .65$, $p < .001$, indicating that accessible AI tools also promote inclusivity. A moderate positive correlation existed between reducing learning gaps (16) and future potential for quality education (19), $r(148) = .47$, $p < .001$, suggesting optimism about AI's role in equity.

Summary of Key Findings/Conclusion

This study investigated secondary school students' perceptions and experiences with AI-powered personalized learning, its impact on engagement, and its contribution to sustainable development in education. Findings revealed that students generally perceive AI tools positively, with high ratings for ease of use ($\bar{x} = 3.92$), relevance ($\bar{x} = 3.78$), confidence ($\bar{x} = 4.01$), and helpful feedback ($\bar{x} = 4.15$), though some expressed concerns about over-reliance ($\bar{x} = 2.88$). Engagement levels were strong, particularly in understanding difficult concepts ($\bar{x} = 4.03$) and enjoying adaptive pacing ($\bar{x} = 4.10$), aligning with Self-Determination Theory's emphasis on autonomy and competence (Ryan & Deci, 2021). Students also recognized AI's role in sustainable development, with high agreement on accessibility ($\bar{x} = 4.12$), inclusivity ($\bar{x} = 3.99$), and environmental benefits ($\bar{x} = 4.08$), supporting SDG 4's goals for equitable education (UNESCO, 2017). However, technical difficulties ($\bar{x} = 2.65$) and perceived inequities in learning opportunities ($\bar{x} = 3.95$) suggest barriers to universal adoption, consistent with the digital divide concerns raised by Selwyn (2021).

Recommendations

1. Educators should integrate AI tools with teacher-led instruction to optimize engagement. AI platforms should complement, not replace, human interaction to support relatedness, as emphasized by Self-Determination Theory. For example, teachers can use AI-generated insights to tailor classroom discussions or provide targeted support, ensuring students benefit from both personalized technology and personal guidance.
2. Provide professional development to enhance teachers' digital literacy, enabling them to effectively incorporate AI tools into curricula and address technical challenges. One way through which teachers can help avoid this is how each lesson is structured so that it involves not only the interests but also the culture of the students so that they feel a sense of ownership in the learning aspect
3. Policymakers need to invest in digital infrastructure, such as reliable internet and devices, to ensure equitable access to AI tools, particularly in rural and underserved areas. This aligns with SDG 4's focus on inclusivity and can reduce disparities in learning opportunities.
4. Fund teacher training programs to build capacity for integrating AI in education, ensuring that educators are equipped to use these tools effectively and equitably.
5. EdTech Developers should try to design user-friendly AI platforms with intuitive interfaces to enhance usability and reduce technical barriers, as students' positive perceptions are linked to ease of use.
6. Prioritize inclusivity by incorporating features like multilingual support and accommodations for diverse learning needs, ensuring AI tools cater to students with varying abilities and backgrounds.

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PSYCHOLOGICAL DETERMINANTS OF LEARNING EFFECTIVENESS: THE ROLE OF EMOTIONAL INTELLIGENCE, SELF-REFLECTIVENESS AND COGNITIVE CONTROL IN ADVANCING QUALITATIVE EDUCATION (SDG-4) FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

Elinah Yemisi Olanrewaju, (PhD)

*Department of Special Education and Guidance and Counselling
Emmanuel Alayande University of Education, Oyo, Oyo State, Nigeria
olanrewajuey@eauedoyo.edu.ng*

Abstract

Effective learning at higher education levels plays a prominent role in sustainable development of nations. While its associative factors have enjoyed research attention, limited studies have examined the combined influence of emotional intelligence, self-reflectiveness, and cognitive control on effective learning among university students in developing nations. These psychological constructs synergistically work together in optimizing learning outcomes. Therefore, this study examined the nexus between those psychological concepts as determinants of learning effectiveness among Nigeria university students. Specifically investigating the roles of emotional intelligence, self-reflectiveness, and cognitive control in promoting learning effectiveness for quality education aligned with Sustainable Development Goal 4. A cross-sectional survey design was employed with 385 students drawn comprising 56.1% females and 75.7% undergraduates. Four validated questionnaires were adopted in generating data for the study. Four null hypotheses are set and tested at 0.05 level of significance, and hierarchical multiple regression analyses were carried out to test the null hypotheses while controlling for socio-demographic variables. Results revealed strong positive correlations among all the psychological constructs and learning effectiveness ($r = .812$ to $.882$, all $p < .001$). Emotional intelligence alone explained 65.4% of variance in learning effectiveness. Self-reflectiveness increased explained variance to 80.3%, cognitive control further increased it to 82.5%. In controlling for demographic variables, the final model explained 84.2% of variance in learning effectiveness, $F(7, 302) = 230.550$, $p < .001$. Self-reflectiveness emerged as the strongest predictor ($\beta = .527$, $p < .001$), cognitive control ($\beta = .331$, $p < .001$), emotional intelligence ($\beta = .092$, $p = .050$). Multicollinearity diagnostics confirmed acceptable levels for all predictors ($VIF < 10$, tolerance $> .10$). The joint influence of emotional intelligence, self-reflectiveness, and cognitive control accounts for a significant portion of the variance in learning effectiveness. Self-reflectiveness demonstrated the most substantial contribution, suggesting its critical role in educational outcomes. These results offer valuable insights for developing evidence-based interventions in enhancing learning effectiveness in higher education contexts, with particular emphasis on fostering self-reflective practices among university students to achieve quality educational goals.

Keywords: Emotional intelligence, self-reflectiveness, cognitive control, learning effectiveness, sustainable development, Nigeria

Introduction

Quality education plays paramount roles in the development of nations, it enhances a holistic development by enabling individuals with critical and deep thinking, creativity, and knowledge acquisition for problem-solving in an ever-changing world. Knowledge acquisition and learning in school especially at the tertiary levels place high premium on some individual inclined traits

among which, are psychological factors through which individuals could perform to the optimum. Tertiary education schooling time is a period of immense intellectual and personal growth wherein students navigate through complex academic challenges, while simultaneously developing critical skills that will shape their future careers for personal and national development.

University students are not only required to acquire established knowledge through qualitative education, but they are also challenged to push boundaries, and generate new ideas in the course of studying. Holistically qualitative education addresses cognitive, emotional, social, and physical development of students, and learning is a multifaceted process that helps in the total development. Some cognitive and psychological concepts such as self-efficacy, self-concept, emotional intelligence, creative thinking, self-reflectiveness, cognitive control among other correlates for effective learning worth studying. These concepts empower individuals to understand themselves and others better; employ strategies, adapt to changes, create ideas, and retain acquired knowledge beyond explicit instructions. They have significant impacts on educational success (Li, Xue, Li & He, 2023).

This study examined the psychological determinants of learning effectiveness among Nigeria university students, focusing specifically on the roles of emotional intelligence, self-reflectiveness and cognitive control on students' learning effectiveness in promoting quality education in alignment with Sustainable Development Goal 4 (SDG-4). Understanding the interplay is crucial to fostering effective learning among tertiary institution students. Sustainable development is a holistic approach that balances economic, social, and environmental needs for transformation, ensuring a livable future for in-coming generations. Qualitative education is a vital instrument through which all three spares of development are piloted for actualization. By investigating these relationships while controlling for relevant socio-demographic factors, this research provided insights into the psychological factors that enhance educational outcomes, and the results inform evidence-based interventions for improving learning effectiveness in higher education contexts.

Learning effectiveness refers to the attainment of specific learning outcomes, measured by changes in knowledge, skills, and attitudes (Gagne, 1970). The concept also relates to the alignment of teaching methods, learning activities, and assessment with learning objectives (Biggs, 1987). More so, it describes the degree to which learning objectives are achieved, as learners acquire the desired knowledge, skills, and attitudes in the course of teaching and learning. Indicators of leaning effectiveness include: academic achievement, critical thinking and problem-solving, adaptability and flexibility, students' engagement, retention and transfer, communication and collaboration among learners, emotional intelligence and total well-being.

Learning effectiveness helps in enhanced educational quality, it also encourages teachers' accountability, and professional job satisfaction. Dimensions of learning effectiveness are: cognitive (knowledge acquisition, retention, and application); affective (attitude change, motivation, and emotional intelligence); psychomotor (skill development, performance, and mastery); social development (collaboration, communication, and teamwork), and metacognitive abilities (self-awareness, reflection, and self-regulation).

Emotional intelligence (EI) refers to the ability to correctly express one's own experience, to recognize one's own and others' emotions, and manage them positively, assuming adequate social behaviours and adequate empathetic attitudes (Goleman, 1995). It also refers to ability to perceive, evaluate and express an emotion; ability to access feelings and/or create them when they facilitate thoughts; ability to understand emotion and emotional knowledge; and ability to regulate emotions to promote emotional and intellectual growth (Salovey & Mayer, 1997). It is a collection

of emotional and social knowledge and skills (Bar-On, 2000), and it is linked to the ability to consciously recognize, use, understand and manage one's own and others' emotions (Domenica, Agostino, & Santuzza, 2020).

Emotional intelligence encompasses self-awareness, self-regulation, motivation, empathy, and social skills which are compressed into three main elements: evaluation and expressions of emotions; regulation of emotions; and the use of emotions. This helps individuals understand their own and other people's emotions to control their thoughts and actions (Lewis, Rees, Hudson, & Bleakley, 2005). In learning, emotional intelligence regulates students' passion to focus on what is being taught, and it also enhances self-motivation and resilience, facilitating good and effective relationships with teachers and peers in and outside the classroom, enhancing growth in mindset of learners.

Emotional feelings have the potential to energize students' thinking, and to interfere with learning (Oatley & Nundy, 1996). If students are overly excited or enthusiastic, they might work carelessly or hastily, rather than working meticulously or carefully. Notably, emotions such as anger, anxiety, grief, and sadness have the potential to distract students' learning efforts by interfering with their mindset, focus and ability to attend to educational tasks in the process of learning. Vance, Fernandez and Biber (1998) observed that characteristics of high emotional intelligence such as: good problem solving skills, ability to get along with peers and adults, likeability and a sense of humour are associated with positive educational progress.

Furthermore, research revealed the relevance of emotional intelligence with respect to social and emotional competencies, which are considered vital for successful academic performance (Rupande, 2015). In other words, emotional intelligence helps students to fully integrate academically and socially within an educational setting. More so, Mohammadi (2008) observed a close positive relationship between creativity and emotional intelligence. EI enhances creativity by regulating emotions and facilitating open-mindedness. It helps manage creative blocks and self-doubt. Nuha and Pedhu, (2021); Wahyuddin, Umiah, and Quraisy (2023) observed that, the higher the level of emotional intelligence of students is; the higher their ability to think creatively. In consonance, Durnali, Orakci and Khalili (2023) also found that emotional intelligence aids an individual's strength in acquiring new knowledge, and several aspects of higher-order thinking, such as problem-solving, interpretation, and abstract thinking. It also supports adaptive learning strategies by fostering a growth mindset that encourages exploration and creativity.

Self-reflectiveness refers to ability to witness and evaluate one's own cognitive, emotional, and behavioural processes. Agouridas and Race (2007) describe self-reflectiveness as a process of personalizing and understanding the contents, process, and the rationales for what individuals have learned. It involves taking time to think about, meditate on, evaluate, and give serious thought to one's behaviours, actions, attitudes, motivations and desires. This is known as individual reflective thinking. Reflective thinking is an active, intentional, and purposeful process of exploration, discovery, and learning (Lin, Hmelo, Kinzer & Secules, 1999). Self-reflectiveness is very important and valuable both at the beginning of experience accumulation, as well as when an obtained information is being synthesized by one's own psychic processes during learning. Finding out the rationale behind one's actions is germane to living a meaningful and fulfilling life, and in achieving one's dream. Developing a self-reflective attitude means that an individual begins to automatically challenge and question why tasks were undertaken in a certain way, rather than how they were carried out (Helyer, 2015).

Self-reflectiveness builds self-awareness, and it aids an individual to form a self-concept that can contribute to self-development. An individual's self-concept includes: thought about his or her

traits, abilities, beliefs, values, roles and relationship (Dishon, Oldmeadow, Critchley & Kaufman, 2017). Without self-reflection, a student can continue making the same mistakes or committing errors. Self-reflection therefore, activates self-analysis, active learning, as well as problem solving. It also helps in reducing cognitive dissonance (a discomfort that is experienced when an individual's behaviour does not align with his or her values), and it gives one greater sense of control. A learner creates his or her individual knowledge when interacting with environment on the basis of his/her previous experience. However, it is not important how distinctly and precisely the rendered knowledge will be related to possessed beliefs and understanding, but creating own personal implications matters (Jerome, 2006).

Students have to step back and reflect on how they make decisions in solving problems, and how a particular set of problem-solving strategies is appropriate or might be improved upon for subsequent decision making. The process of reflection includes debriefing and reframing to expand students' beliefs and understanding, using journaling as a form of reflection to help students develop conscious awareness, and using prompts and feedback to guide their reflection (Roskos, Vukelich & Risko, 2001). Through reflection, students could relate their personal experiences to a wider perspective, which would help them to see the bigger picture. Larsen, London and Emke (2016) submit that reflection is not just for social purpose, it can also be used to influence students' learning from experience, increase the awareness of their thoughts and actions, and to increase their perceived recall of experiences. Self-reflectiveness enables learners to determine facts, finding ways for solutions to any given challenge or tasks (Altın & Saracaloğlu, 2018; Liao & Wang, 2019).

Examining the influence of self-reflective practices on some university students' learning outcomes, Johnson and Kiviniemi (2016) observed significant improvement in students' understanding of course materials with the aid of reflective practices. Self-reflectiveness helps students to ruminate on their actions and performance, and on what they can do to improve their performance. It stimulates students to questioning their philosophy and beliefs and make connections between those beliefs and their assignments, thereby, linking theory to their personal beliefs. Therefore, incorporating self-reflectiveness into educational learning strategies can substantially enhance students' learning outcomes, a key indicator of learning effectiveness.

Cognitive control is a distinctive characteristic of the human brain, which distinguishes itself from all other mammalian species. It refers to the ability to override automatic or habitual responses and instead select goal-appropriate actions (Duncan & Owen, 2000). An ability to selectively focus attention, suppress irrelevant information, and switch between tasks or mental sets which relates to a set of neurocognitive processes is typically associated with frontal lobe activity, that maximize the adaptability of the human cognitive system to contextual demands (Miller & Cohen, 2001). This is an executive function that regulates and coordinates cognitive processes, including attention, working memory, and goal-directed behaviour (Stuss & Alexander, 2000; Fuster, 2003).

The definitions given to cognitive control show that it is a brain related activity that helps individuals to resist the urge to settle for the first solution that comes to mind over a challenge. It helps individuals to explore alternative pathways and possibilities in handling challenges. Cognitive processes allow an organism to configure itself toward optimizing performance through dynamic adjustments in attention allocation, response selection, and maintenance of task-related goals (Botvinick, Braver, Barch, Carter & Cohen, 2001). Individual cognitive control requires employment of cognitive strategies such as rehearsal, elaboration, organization, and metacognitive strategies such as self-questioning.

Cognitive control fuels effective learning as the unconscious knowledge that is being processed within the brain can be retrieved and applied in novel situations, leading to unexpected breakthroughs and innovative solutions. In other words, cognitive control plays an important role in critical thinking that enhances learning effectiveness via attention control, working memory, conflict monitoring, error detection and correction, goal-directed behaviour, and executive functions, such as planning, decision-making, and problem-solving. Smith and Jonides (2013) observed a significant positive correlation between students' cognitive control and their academic success. When students optimize cognitive control in learning, they can device adaptive behavioural changes that are commensurate for dynamic and pragmatic changes for a developing society.

Hypotheses

Four null hypotheses are generated in piloting the study.

H₀₁: Emotional intelligence would be positively associated with learning effectiveness among tertiary institution students.

H₀₂: Self-reflectiveness would be positively associated with learning effectiveness among tertiary institution students.

H₀₃: Cognitive control would be positively associated with learning effectiveness among tertiary institution students.

H₀₄: The combined influence of emotional intelligence, self-reflectiveness, and cognitive control would explain a significant portion of the variance in learning effectiveness among tertiary institution students.

Method

Participants

The study sample comprised 385 students recruited from Nigerian universities. Participants ranged in age from 18 to over 40 years, with the majority (69.4%) falling within the 18-25 years age range. Specifically, 21.1% were aged 18-20 years, 48.3% were aged 21-25 years, 18.5% were aged 26-30 years, 6.5% were aged 31-35 years, 2.9% were aged 36-40 years, and 2.6% were 40 years and above. The sample was predominantly female (56.1%) compared to male participants (43.9%). Regarding academic characteristics, the majority of participants were undergraduates (75.7%), while 15.6% were pursuing Masters Degrees, and 7.3% were doctoral students. In terms of year of study, 22.4% were first-year students, 43.4% were in their second year, 17.8% were third-year students, 10.9% were fourth-year students, and 5.5% were in their fifth year or beyond. The sample showed some missing data across variables, with valid responses ranging from 348 to 385 participants across different measures. See Table 1 for participants' characteristics.

Measures

Four validated scales were used to assess the study variables. The Emotional Intelligence Scale (EIS), developed by Salovey and Mayer (1990), consists of 20 items across four dimensions: perceiving emotions, using emotions, understanding emotions, and managing emotions. This scale yielded a Cronbach's alpha of 0.93 for the present study. The Cognitive Control Scale (CCS) by Posner and Rothbart (2007) has 20 items that measure attentional control, cognitive flexibility, working memory, and error detection and correction. The internal consistency for this measure produced a Cronbach's alpha of 0.94. Additionally, the Self-Reflectiveness Scale by Jones and

Snyder (2007) was used. This scale consisted of 20 items that assessed self-awareness, reflective thinking, emotional awareness, and self-regulation. For this study, the Cronbach's alpha for the Self-Reflectiveness Scale was 0.95.

The Learning Effectiveness Scale (LES) by McKeachie, Pintrich, and Lin (1985) was also utilized to measure the dependent variable (learning effectiveness of students). This scale consisted 22 items that measured cognitive learning, affective learning, and behavioural learning. The Cronbach's alpha for the Learning effectiveness scale in the current study was 0.96. This indicated that all the scales demonstrated high reliability in assessing the study variables. All scales except the LES were computed as mean scores (range 1-5), while the LES was computed as a total score. Higher scores on all measures indicated greater levels of the respective constructs.

Analytical Approach

Descriptive statistics and Pearson correlations were calculated to examine variable distributions and their bivariate relationships. Hierarchical multiple regression analyses were performed to test the study hypotheses, using this approach to investigate the incremental contribution of each psychological predictor while controlling for socio-demographic variables. Two separate hierarchical models were analyzed: one focusing on the psychological predictors alone and the other incorporating socio-demographic controls (gender, age, year of study, level of study) to ensure the robustness of the findings. Multi-collinearity diagnostics (tolerance and VIF values) were evaluated to determine the appropriateness of including highly correlated predictors in the regression models. Internal consistency reliability was assessed using Cronbach's alpha for all scales. All analyses were carried out using SPSS version 29, with significance set at $p < .05$.

Results

Table 1: Socio-demographic characteristics of Participants

Characteristic	N	%
Gender		
Male	169	43.9
Female	216	56.1
Age Group		
18-20 years	81	21.1
21-25 years	185	48.3
26-30 years	71	18.5
31-35 years	25	6.5
36-40 years	11	2.9
40+ years	10	2.6
Level of Study		
Undergraduate	281	75.7
Masters	58	15.6
Doctoral	27	7.3
Year of Study		
First year	78	22.4
Second year	151	43.4
Third year	62	17.8
Fourth year	38	10.9
Fifth year or more	19	5.5

Note. Total N = 385. Percentages may not sum to 100% due to missing data and rounding.

Table 2: Descriptive Statistics and Correlations among Study Variables

Variable	M	SD	1	2	3	4
1. Emotional Intelligence	3.46	0.83	—			
2. Self-Reflectiveness	3.58	0.91	.833**	—		
3. Cognitive Control	3.49	0.91	.849**	.888**	—	
4. Learning Effectiveness	77.66	20.37	.812**	.882**	.871**	—

Note. N ranges from 361 to 379. ** $p < .01$. Emotional Intelligence, Self-Reflectiveness, and Cognitive Control are measured on a 1-5 scale (means reported). Learning Effectiveness is measured as a total score ranging from 22-110.

Table 3: Hierarchical Multiple Regression Analysis Predicting Learning Effectiveness (Without Socio-demographic Controls)

Step	Predictor	R ²	ΔR^2	F Change	B	T	P
1	Emotional Intelligence	.654	.654	654.949***	.809	25.592	< .001
2	Self-Reflectiveness	.803	.149	260.749***	.698	16.148	< .001
	Emotional Intelligence				.227	5.254	< .001
3	Cognitive Control	.825	.022	43.456***	.363	6.592	< .001
	Self-Reflectiveness				.491	9.540	< .001
	Emotional Intelligence				.089	1.933	.054

Note. N = 349. *** $p < .001$. Final model: $F(3, 345) = 540.646$, $p < .001$.

Table 4: Hierarchical Multiple Regression Analysis Predicting Learning Effectiveness (with socio-demographic controls)

Predictor	R ²	ΔR ²	F Change	B	T	p	Tolerance	VIF
Step 1: Demographic Controls	.011	.011	0.879			.477		
Step 2: + Emotional Intelligence	.667	.656	599.723***					
Step 3: + Self-Reflectiveness	.824	.157	270.712***					
Step 4: + Cognitive Control	.842	.018	34.489***					
Final Model Coefficients:								
Gender				-.025	-1.089	.277	.970	1.030
Age				.031	1.293	.197	.906	1.104
Year of Study				.015	0.642	.522	.914	1.095
Level of Study				-.033	-1.382	.168	.925	1.081
Emotional Intelligence				.092	1.970	.050	.239	4.180
Self-Reflectiveness				.527	10.039	< .001	.190	5.277
Cognitive Control				.331	5.873	< .001	.164	6.080

Note N = 310. *** $p < .001$. Final model: $F(7, 302) = 230.550$, $p < .001$. Durbin-Watson = 1.967. VIF = Variance Inflation Factor. Tolerance values $> .10$ and VIF values < 10 indicate acceptable levels of multicollinearity.

The descriptive statistics revealed that participants exhibited moderate to high levels across all measured constructs (see Table 2). Self-reflectiveness recorded the highest mean score ($M = 3.58$, $SD = 0.91$, range = 1- 5), followed by cognitive control ($M = 3.49$, $SD = 0.91$, range = 1- 5) and emotional intelligence ($M = 3.46$, $SD = 0.83$, range = 1- 5). Learning effectiveness, measured as a total score, yielded a mean of 77.66 ($SD = 20.37$) out of a possible range of 22-110. The standard deviations indicated reasonable variability in responses across all measures, suggesting adequate discrimination among participants. Sample sizes ranged from 366 to 379 participants, with a valid complete data sample of 349 participants across all variables.

The correlation analysis revealed strong positive associations among all study variables (Table 2). Emotional intelligence, self-reflectiveness, and cognitive control showed very high inter-correlations ($r = .833$ to $.888$, all $p < .001$), indicating substantial shared variance among these psychological constructs. Each of these variables also demonstrated strong positive correlations with learning effectiveness ($r = .812$ to $.882$, all $p < .001$), providing initial support for the hypothesized relationships. The magnitude of these correlations suggested that students with higher emotional intelligence, greater self-reflectiveness, and better cognitive control were more likely to report higher levels of learning effectiveness.

The relationships between socio-demographic variables and study constructs (predictors) revealed notable patterns. Gender showed a small but significant positive correlation with emotional intelligence ($r = .118$, $p < .05$), suggesting that female participants reported slightly higher emotional intelligence scores. Age demonstrated substantial positive correlations with year of study ($r = .168$, $p < .01$) and level of study ($r = .246$, $p < .01$). This was expected given the natural progression through academic levels. None of the socio-demographic variables showed significant correlations with learning effectiveness, indicating that psychological constructs, rather than demographic characteristics, were the primary drivers of learning outcomes in the study sample.

A hierarchical multiple regression analysis was carried out to test the fourth hypothesis concerning the joint influence of emotional intelligence, self-reflectiveness, and cognitive control on learning effectiveness (see Table 3). This analytical method was ideal because it enabled the assessment of the incremental contribution of each predictor while controlling for previously entered variables, thus directly addressing the hypothesis regarding the combined predictive power.

Model 1 included only emotional intelligence as a predictor and explained 65.4% of the variance in learning effectiveness ($R^2 = .654$, $F(1,347) = 654.949$, $p < .001$). Model 2 added self-reflectiveness, resulting in a substantial increase in explained variance to 80.3% ($\Delta R^2 = .149$, F change $(1,346) = 260.749$, $p < .001$). Model 3 incorporated cognitive control, further increasing the explained variance to 82.5% ($\Delta R^2 = .022$, $F(1,345) = 43.456$, $p < .001$). The final model was highly significant, $F(3,345) = 540.646$, $p < .001$, demonstrating that the combination of all three psychological constructs explained a substantial 82.5% of the variance in learning effectiveness among tertiary institution students.

In the final model, all the three predictors remained significant: self-reflectiveness emerged as the strongest predictor ($\beta = .491$, $t = 9.540$, $p < .001$), followed by cognitive control ($\beta = .363$, $t = 6.592$, $p < .001$), while emotional intelligence maintained a marginally significant contribution ($\beta = .089$, $t = 1.933$, $p = .054$). These findings strongly supported the fourth hypothesis, showing that the combined influence of these psychological constructs explained a significant and substantial portion of variance in learning effectiveness.

Additionally, a separate hierarchical multiple regression analysis was conducted, incorporating socio-demographic control variables to ensure the robustness of the main findings (see Table 4). Model 1 included the control variables (gender, age, year of study, and level of study) but explained only 1.1% of the variance ($R^2 = .011$, $F(4,305) = .879$, $p = .477$), confirming that demographic factors had minimal influence on learning effectiveness. Model 2 added emotional intelligence, dramatically increasing explained variance to 66.7% ($\Delta R^2 = .656$, F change $(1,304) = 599.723$, $p < .001$). Model 3 incorporated self-reflectiveness, further increasing variance explained to 82.4% ($\Delta R^2 = .157$, $F(1,303) = 270.712$, $p < .001$). Model 4 added cognitive control, achieving a final explained variance of 84.2% ($\Delta R^2 = .018$, $F(1,302) = 34.489$, $p < .001$).

The final controlled model revealed that self-reflectiveness was the strongest predictor ($\beta = .527$, $t = 10.039$, $p < .001$), followed by cognitive control ($\beta = .331$, $t = 5.873$, $p < .001$), and emotional intelligence ($\beta = .092$, $t = 1.970$, $p = .050$). The inclusion of control variables did not substantially alter the pattern of the results, confirming the robustness of the psychological predictors. The Durbin-Watson statistic of 1.967 indicated acceptable independence of residuals. Multi-collinearity diagnostics were examined to ensure the appropriateness of the regression models (see Table 4). Tolerance values for all predictors remained above the commonly accepted threshold of .10, and VIF values stayed within acceptable limits below 10, indicating that multi-collinearity did not pose significant interpretational concerns for the regression analyses. In the final model, tolerance values ranged from .164 to .239, with corresponding VIF values between 4.180 and 6.080, all falling within established guidelines for acceptable multi-collinearity levels.

The collinearity diagnostics confirmed that, while the predictors shared some common variance, each contributed unique explanatory power to the prediction of learning effectiveness, supporting the theoretical framework underlying the study. The control variables (gender, age, year of study, and level of study) showed minimal multi-collinearity concerns, with tolerance values above .90 and VIF values close to 1.0, confirming their independence from the main psychological predictors. This pattern further validated the analytical approach and supported the interpretation that the psychological constructs, rather than demographic characteristics, were the primary drivers of learning effectiveness in this sample.

Discussion of Findings

The three psychological constructs considered in this study (emotional intelligence, cognitive control, and self-reflectiveness) indicated related but distinct psychological concepts influencing learning effectiveness. All the three are movers of learning effectiveness. This explains strong positive association observed. This aligns with Rupande (2015) findings which revealed that, emotional intelligence competencies are vital for successful academic performance. The result is also in tandem with Durnali et al. (2023) who found that, emotional intelligence aids in individuals' strength in learning. It also corroborates Nuha & Pedhu (2021) and Wahyuddin et al. (2023) that found that, the higher the level of emotional intelligence of students, the higher their ability to think creatively. Effective learning and creativity go hand in hand, hence the link with emotional intelligence ability.

Findings of this study further indicated strong positive correlation of the independent variables with the criterion (dependent) variable. The strong inter-correlations among the three psychological constructs are theoretically expected, as emotional intelligence, self-reflectiveness, and cognitive control indicate related but distinct psychological processes that naturally share variance. This pattern of relationships is consistent with the literature suggesting these constructs work synergistically in educational contexts. This result is in consonance with Smith and Jonides (2013) who observed significant positive correlation between students' cognitive control and their academic success. Findings further buttresses Johnson and Kiviniemi (2016) that earlier observed significant improvement in students' understanding of course materials with the aid of reflective practices.

More so, findings support Altin and Saracaloglu (2018); Liao and Wang (2019). These researchers observed that, self-reflectiveness enabled learners to determine facts, finding ways for solutions to puzzles/challenges. Each of the independent variables having positive influence on learning effectiveness implies that, students that possessed higher emotional intelligence; greater self-reflectiveness; and better cognitive control reported higher levels of learning effectiveness. However, self-reflectiveness was the strongest predictor of learning effectiveness in this study.

Conclusion

Emotional intelligence, self-reflectiveness, and cognitive control are important determinants of effective learning among university students. The interplay between the studied psychological constructs can have a significant impact on learning outcomes. Emotional intelligence enables students to understand themselves and others better in navigating through learning process, and in achieving academic excellence. Enhanced decision-making and problem-solving skills that are derivable from cognitive control and self-reflectiveness worth being tapped from for both personal and national development. Investing towards qualitative education for learning effectiveness would usher in rapid development in every sphere of life builds. Adequate preparation of students to handling real-world challenges should be the target of education stakeholders in Nigeria.

Recommendations

Based on the findings of this study, recommendations were made thus:

- Educational Psychologists should be engaged in enlightenment programmes through seminars and workshops towards the development of psychological constructs such as, emotional intelligence, cognitive control, locus of control and self-reflectiveness in school in order to groom students for effective self-regulation and utilization of those constructs for effective learning in and outside the school.
- Teaching strategies such as project-based learning, learning-to-learn, brainstorming, mind mapping, peer assessment and feedback, flipped classroom, flexible and adaptive assessments that can boost emotional intelligence, cognitive control and self-reflectiveness for effective learning among students should be employed by teachers at different levels of education.
- Integrating creativity enhanced skills into early education curriculum would help individual learners to develop strategies for learning effectiveness.
- Schools to encourage interdisciplinary collaboration that promotes sharing of ideas among students in different fields of study.
- University curriculum should be re-designed incorporating student self-regulation programmes to teaching. This would wire students for high scholastic acumen for personal growth, and national sustainable development.

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AI FOR POLICY COMPLIANCE AND SUSTAINABLE EARLY CHILDHOOD EDUCATION IN NIGERIA: A THEORETICAL PERSPECTIVE

Bolaji Gabriel Popoola (Ph.D)

Department of Educational Management,
Faculty of Specialised and Professional Education,
Emmanuel Alayande University of Education, Oyo
popoolabg@eauedoyo.edu.ng

Abstract

Sustainable ECE is central to achieving Sustainable Development Goal 4 (SDG 4), which emphasises inclusive and equitable quality education. However, policy implementation in Nigeria's ECE sector continues to face significant challenges due to weak regulatory enforcement, poor data systems, and limited monitoring capacity. This paper engage in a theoretical exploration of the role of Artificial Intelligence (AI) in enhancing policy compliance and promoting sustainable practices in Early Childhood Education (ECE) centres in Nigeria. Drawing from Policy Implementation Theory, the Technology Acceptance Model (TAM), Technological Determinism, and Systems Theory, this paper examines the conceptual foundations, potential applications, and limitations of AI-based monitoring mechanisms. The paper theorises how AI can strengthen transparency, automate compliance checks, support professional development, and engage stakeholders, all while upholding ethical standards and data privacy. It further identifies existing knowledge gaps and the need for empirical studies to assess the real-world applicability and effectiveness of AI tools in Nigeria's educational landscape. The paper concludes with recommendations, including the development of policy frameworks aligned with SDG 4, investment in digital infrastructure for rural and underserved areas, structured capacity-building for stakeholders, and the establishment of ethical guidelines to safeguard data privacy, child safety, and algorithmic fairness in AI adoption.

Keywords: Artificial Intelligence, Policy Compliance, Early Childhood Education, Sustainable Development Goal 4 (SDG 4), Educational Monitoring Systems

Introduction

Early Childhood Education (ECE) plays a foundational role in shaping the cognitive, emotional, and social development of children. The United Nations' Sustainable Development Goal 4 (SDG 4) explicitly advocates for inclusive and equitable quality education and promotes lifelong learning opportunities for all (UN, 2015). In Nigeria, the National Policy on Education (FRN, 2013) recognises the importance of ECE, mandating its structured provision in formal and informal settings. Despite this, challenges persist in translating policies into practice due to weak enforcement mechanisms, capacity limitations, and inconsistent monitoring for compliance.

Policy implementation in Nigeria's educational sector, especially at the foundational level, has been plagued by inconsistencies, weak oversight, and ineffective monitoring mechanisms, all of which have called into question the extent of compliance (Odukoya, 2013; Ukeje, 2018; Popoola, 2019). Although there are clearly defined policies, such as the National Policy on Education and the Early Childhood Care and Education (ECCE) framework, many ECE centres operate without adequate supervision, compliance checks, or accountability structures. These lapses affect the quality of foundational education, with early learning being a critical period in a child's cognitive, emotional, and social development. As UNESCO (2019) notes, early years education is not only

crucial for individual development but also for long-term national growth, making it imperative to ensure full and effective implementation of educational policies.

Traditional supervision models employed by regulatory agencies often suffer from timeliness issues, inefficiency, and human bias (Ogundele & Ojo, 2020). Periodic physical inspections which are though necessary, are insufficient to maintain continuous oversight due to logistical, financial, and human resource constraints. Consequently, numerous ECE centres could not have met the minimum standards for infrastructure, curriculum delivery, teacher qualification, and child safety.

One of the core challenges in this regard is the absence of timely, accurate, and actionable data to guide policy enforcement and evaluation for compliance. Limited manpower for inspection and the lack of digital systems compounds the difficulties of policy implementation. These limitations open up spaces for non-compliance, including the operation of unregistered centres, use of unqualified personnel, and inadequate learning environments. Amid these challenges, the rise of Artificial Intelligence (AI) technologies presents promising possibilities for strengthening educational governance. Globally, AI has been harnessed to improve decision-making, automate routine administrative tasks, and enhance oversight in various sectors (Holmes et al., 2019). In education specifically, AI applications are evident in personalised learning, behaviour tracking, and data analytics.

In Nigeria, where capacity constraints hamper the effective implementation of ECE policy, AI tools such as real-time reporting dashboards, AI-driven auditing platforms, and sensor-based attendance systems could bridge existing gaps. In other contexts, the deployment of digital tools in Early Childhood Education (ECE) has facilitated continuous monitoring, real-time feedback, and automated compliance assessments, capabilities that are often beyond the reach of traditional systems (Gallivan et al., 2023; Nolan & McFarlane, 2023). This paper presents a theoretical analysis of the potential application of AI in improving policy compliance and promoting sustainability in Nigeria's ECE sector. Drawing on theories such as Policy Implementation Theory, Technological Determinism, Systems Theory, and the Technology Acceptance Model (TAM), the paper argues that AI can serve as a complementary mechanism to improve transparency, efficiency, and accountability in ECE policy execution.

Ultimately, this study seeks to lay a conceptual foundation for future empirical research, evaluating the feasibility, effectiveness, and ethical implications of integrating AI into the implementation monitoring and governance structures of ECE in Nigeria. By leveraging AI in a manner that is contextually relevant and ethically grounded, Nigeria can enhance the sustainability and inclusiveness of early childhood education, advancing toward the goals of SDG 4.

Conceptual and Theoretical Framework

This theoretical paper is underpinned by three interrelated perspectives that offer a multidimensional lens for understanding the potential of Artificial Intelligence (AI) in enhancing policy compliance within Early Childhood Education (ECE) centers in Nigeria. These frameworks are: Policy Implementation Theory, Technological Determinism, and Systems Theory. They provide insights into the mechanisms, implications, and systems-level functions of AI-based monitoring in educational contexts.

Policy Implementation Theory, as proposed by Mazmanian and Sabatier (1983), emphasizes that the success of any policy depends significantly on administrative capacity, clear objectives, resource availability, monitoring mechanisms, and enforcement strategies. This theory is

particularly relevant in the Nigerian ECE context, where weak implementation structures often derail the goals of well-intended educational policies. Integrating AI into this framework suggests that technological tools can enhance administrative efficiency and accountability. For instance, AI can facilitate timely data collection, automate compliance checks, and generate alerts when regulatory standards are violated. These capabilities align with the theory's emphasis on monitoring and enforcement, offering a modern means of strengthening traditional policy execution systems.

Technological Determinism, popularised by McLuhan (1964), posits that technological innovations are not passive tools but active agents of societal change. In this view, the adoption of AI in educational governance is not merely an enhancement but a transformation of the existing system. When AI is used to monitor teacher attendance, assess classroom quality, or flag policy violations, it not only changes how compliance is achieved but may also influence stakeholders' behaviors, institutional norms, and administrative processes. Thus, technology becomes a driving force in reshaping educational accountability and governance structures.

Systems Theory, introduced by Bertalanffy (1968), sees educational institutions as interconnected systems that require continuous feedback for adaptation and improvement. From this perspective, AI technologies can be conceptualised as components of a feedback loop, collecting, processing, and relaying data that inform decision-making and policy evaluation. In ECE settings, real-time analytics from AI systems can provide policymakers with actionable insights into center performance, resource use, and regulatory adherence, thereby enabling more responsive and evidence-based interventions.

Together, these three theories offer a robust conceptual foundation for exploring how AI can be systematically integrated into the monitoring and enforcement of education policy compliance in Nigeria.

Artificial Intelligence in Education

Artificial Intelligence (AI) has increasingly gained prominence in the field of education, transforming not only teaching and learning processes but also administrative and institutional operations. Traditionally, AI applications in education began with adaptive learning technologies designed to personalise content delivery based on individual student progress and learning styles (Luckin et al., 2016). Over time, the scope has broadened to include a range of administrative and operational functions such as attendance monitoring, facial recognition, behavioral analytics, and performance tracking (Zawacki-Richter et al., 2019).

In technologically advanced contexts like China, Canada, and the United States, AI is already being deployed to enhance school accountability and operational efficiency. For example, AI tools are used to monitor instructional time, track teacher and student attendance through biometric systems, evaluate classroom engagement via camera analytics, and ensure institutional compliance with established regulatory frameworks (Holmes et al., 2021). These systems not only collect large volumes of data in real-time but also facilitate predictive analysis that supports data-driven decision-making in educational management.

Furthermore, Williamson and Eynon (2020) argue that AI contributes to the emergence of “data-driven” governance in education, where decisions are increasingly informed by algorithms, dashboards, and performance metrics. While this shift has the potential to enhance transparency and efficiency, it also raises questions about data ethics, surveillance, and the unintended

consequences of automation in learning environments. Nevertheless, when responsibly implemented, AI can be a valuable tool for improving policy enforcement, school inspections, and administrative accountability.

Despite these global trends, the integration of AI in education across Africa, and particularly in Nigeria remains limited (Adeleke & Kazeem, 2021). Several factors hinder its adoption, including inadequate digital infrastructure, limited internet penetration in rural areas, poor funding of educational institutions, and a general lack of technical expertise. Moreover, the application of AI has largely focused on enhancing learning delivery and has not extended sufficiently into governance and policy compliance mechanisms, especially at the foundational level of education such as Early Childhood Education (ECE).

ECE is a particularly sensitive and strategic area of educational development where effective monitoring is crucial. However, traditional compliance systems, such as manual inspections and periodic evaluations, are often inefficient and inconsistent. AI technologies could offer innovative alternatives by automating inspection routines, detecting non-compliance through pattern recognition, and providing continuous monitoring without the need for physical presence. Yet, empirical studies examining the feasibility, acceptability, and effectiveness of AI-based compliance monitoring in ECE settings, especially within the Nigerian context are scanty.

This gap in the literature underscores the need for further theoretical and empirical exploration. Understanding how AI can be tailored to suit Nigeria's unique educational and infrastructural realities is crucial for its successful implementation. Therefore, this paper aims to bridge this knowledge gap by proposing a conceptual foundation for the application of AI in policy monitoring and compliance in Nigerian ECE centers.

Policy Compliance in Nigerian Early Childhood Education

Different states in Nigeria have educational policies stipulating the minimum standards required for every level of education, from Early Childhood Education (ECE) to secondary schools. According to Popoola (2019), it is assumed that a minimum standard is only as effective as the extent to which it is complied with. However, the objective of setting such a standard may not be achieved if the process expected to ensure compliance is compromised.

Policy compliance in Nigeria's Early Childhood Education (ECE) sector remains a persistent challenge, despite the existence of well-articulated frameworks such as the National Policy on Education and the National Minimum Standards for Early Childhood Care and Education Centres (FRN, 2013). These policies outline critical requirements for teacher qualifications, pupil teacher ratios, learning environments, curriculum standards, and infrastructural safety. However, compliance with these guidelines is frequently undermined by a host of systemic challenges, including inadequate funding, institutional corruption, weak supervision mechanisms, and a shortage of trained personnel (Ejeh, 2006).

In many cases, ECE centers, both public and private operate with minimal oversight, often bypassing regulatory requirements without facing sanctions. Government agencies tasked with quality assurance frequently lack the resources and capacity to conduct routine monitoring. As a result, substandard learning conditions, underqualified caregivers, and unregistered centers continue to proliferate, especially in underserved rural and peri-urban areas. Traditional methods of monitoring, such as periodic physical inspections and manual record reviews, have proven

insufficient for ensuring effective compliance. These approaches are often hampered by periodical delays, lack of transparency, and susceptibility to human error or manipulation.

Emerging technologies, particularly AI, offer promising alternatives to these outdated monitoring methods. AI-powered tools, such as sensor-based attendance tracking systems, digital logbooks with automatic data entry, and surveillance analytics capable of detecting unsafe practices or overcrowding have the potential to transform the compliance landscape in Nigerian ECE (Zhou et al., 2020; Zawacki-Richter et al., 2019; and Holmes et al., 2019). These technologies can facilitate real-time data collection, automate reporting, and flag anomalies for further inspection, thereby enhancing the capacity of oversight bodies to enforce standards more efficiently and objectively.

However, the successful deployment of AI in this context requires a nuanced understanding of the socio-political and infrastructural realities in Nigeria. Factors such as erratic power supply, limited internet connectivity, digital illiteracy among educators, and resistance to surveillance-based tools could hinder adoption. Moreover, issues related to data privacy, ethical implementation, and community acceptance must be carefully addressed to ensure that technology serves as a supportive tool rather than a source of conflict or exclusion. Therefore, while AI presents a compelling opportunity to strengthen policy compliance in ECE, its integration must be guided by context-sensitive strategies that align with local needs, values, and capacities.

Advantages and Shortcomings of AI-Based Monitoring

The integration of Artificial Intelligence (AI) into policy monitoring and compliance mechanisms in the education sector offers transformative potential for enhancing governance, accountability, and service delivery. As educational systems increasingly seek innovative approaches to manage quality and enforce standards, AI emerges as a powerful tool capable of addressing long-standing challenges associated with traditional monitoring systems. Among the core advantages of AI-based monitoring are its ability to enhance efficiency, accuracy, and objectivity in data gathering and analysis.

A primary benefit of AI technologies is their capacity for continuous, real-time data collection and analysis that manual inspection processes often lack. Traditional compliance mechanisms typically depend on periodic supervisory visits, human evaluations, and retrospective reporting, which are frequently delayed, inconsistent, or incomplete. In contrast, AI systems can operate for twenty-four hours continuously, capturing live data from schools regarding attendance, infrastructure use, teacher engagement, and student behaviour (Williamson & Eynon, 2020). For example, AI-enabled sensor technologies and digital logbooks can identify patterns of teacher absenteeism, detect overcrowded classrooms, or even flag violations of health and safety protocols. These insights can trigger instant alerts to school administrators or regulatory bodies, thereby enabling timely intervention and mitigating risks before they escalate.

Another key strength of AI is its ability to present complex information in simplified and visual formats, such as dashboards or heat maps. These visual analytics tools help policymakers and education managers make informed, evidence-based decisions regarding policy implementation and resource allocation (Holmes et al., 2021). By automating repetitive data processing tasks, AI can free up human capacity and reduce the administrative burden on school leaders, allowing them to focus more on instructional leadership and learner outcomes.

Furthermore, AI can enhance transparency and objectivity in school evaluation processes. Human-led assessments are vulnerable to subjectivity, bias, and, in some contexts, corruption. AI systems, when properly designed and calibrated, can introduce standardised procedures for monitoring compliance with national policies and educational standards (Zawacki-Richter et al., 2019). This not only improves the credibility of oversight mechanisms but also fosters greater trust among stakeholders, including parents, teachers, and education authorities.

Despite these advantages, several limitations and concerns are associated with the adoption of AI-based monitoring in education. They include the following:

- a. **data privacy and protection.** AI systems often rely on large volumes of personal and institutional data to function effectively. When this data includes sensitive information about children, educators, or school operations, there is a heightened risk of privacy breaches, unauthorised access, and data misuse. In contexts where robust data governance frameworks are absent or underdeveloped, these risks become even more pronounced (Selwyn, 2019). The implications can range from reputational damage to potential harm to learners and educators.
- b. **over-surveillance.** While AI monitoring may increase efficiency, it can also create an environment of constant scrutiny. Educators and school administrators, particularly in public or under-resourced schools, may feel pressured or micromanaged, which could lead to stress, demoralisation, or resistance to reform efforts. An overreliance on AI metrics might also reduce educational quality to quantifiable indicators, overlooking the relational and emotional aspects of teaching and learning that are harder to measure.
- c. **digital inequality** poses a significant barrier to the widespread and equitable adoption of AI monitoring systems. In many low-resource settings, such as rural or marginalised communities in Nigeria, schools may lack the necessary digital infrastructure, reliable electricity, internet connectivity, or trained personnel to implement and maintain AI systems (Adeleke & Kazeem, 2021). As a result, better-resourced schools may benefit disproportionately, further widening the gap between privileged and disadvantaged institutions in terms of policy enforcement and accountability.

To mitigate these shortcomings, it is crucial that the implementation of AI in education monitoring is guided by **ethical principles and inclusive practices**. Establishing clear data protection laws, obtaining informed consent, ensuring transparency in algorithmic decision-making, and actively involving stakeholders, particularly teachers and parents who are necessary steps toward building trust and legitimacy. Moreover, policies must promote capacity-building among educators, ensuring they have the knowledge and skills to work effectively with AI tools. Investments in digital infrastructure should also prioritise equitable access, especially for schools in underserved areas.

Ultimately, although artificial intelligence-based monitoring offers considerable potential for the transformation of educational governance, its implementation must be context sensitive, ethically grounded, and socially inclusive if it is to contribute meaningfully to the attainment of Sustainable Development Goal 4, which seeks to ensure inclusive and equitable quality education for all.

Conclusion

AI-based monitoring presents a promising and potentially transformative solution to the persistent challenges of policy compliance in Nigerian Early Childhood Education (ECE). Drawing from theoretical perspectives, including policy implementation theory, technological determinism, and

systems theory, this paper has argued that AI technologies can complement traditional inspection methods by improving efficiency, accountability, and real-time data management. AI tools such as automated attendance systems, digital logbooks, and surveillance analytics offer the capacity to enhance oversight where human-led approaches have often failed due to corruption, resource constraints, and administrative inefficiencies.

However, the success of AI integration in ECE governance is not guaranteed. Its effectiveness hinges on context-specific adaptation, ethical implementation, and the establishment of clear data protection and regulatory frameworks. Importantly, while the theoretical justification for AI use in educational compliance is strong, there is a significant need for empirical research to validate these assumptions. Future studies should explore institutional readiness, stakeholder perceptions, cost-effectiveness, and the actual impact of AI on compliance outcomes in diverse Nigerian settings. Such evidence is essential for crafting sustainable and equitable AI strategies that not only support policy enforcement but also respect the rights and needs of all educational stakeholders, especially young learners in early childhood centers.

Recommendations

Based on the theoretical insights provided in this study, the following recommendations are proposed to guide the effective integration of Artificial Intelligence into policy compliance monitoring for sustainable Early Childhood Education (ECE) in Nigeria:

1. **Policy Alignment and Framework Development:** Educational authorities should develop national and sub-national frameworks that formally recognise and support the integration of AI technologies in educational monitoring systems, ensuring alignment with the National Policy on Education and SDG 4.
2. **Investment in Infrastructure:** Government and private stakeholders must invest in digital infrastructure, particularly in underserved and rural areas, to enable the deployment of AI-based monitoring tools such as sensor-based attendance systems and digital logbooks.
3. **Capacity Building and Training:** There should be structured training programmes for school administrators, educators, and inspectors on the use, interpretation, and ethical management of AI tools in ECE centres.
4. **Ethical Guidelines and Data Privacy Regulations:** Policies should be developed to address data protection, child safety, algorithmic bias, and accountability in the use of AI for educational monitoring.
5. **Pilot Testing and Local Adaptation:** AI technologies should be piloted in selected ECE centres across diverse contexts in Nigeria to test feasibility, scalability, and cultural adaptability before full-scale implementation.
6. **Collaborative Partnerships:** Multisectoral collaborations involving education ministries, technology developers, research institutions, and international development partners should be fostered to drive innovation and share best practices.
7. **Continuous Evaluation and Feedback Loops:** Monitoring and evaluation mechanisms should be built into AI systems to ensure ongoing assessment of impact, responsiveness to changing conditions, and iterative improvement.

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NURTURING EXCELLENCE IN EARLY CHILDHOOD EDUCATION THROUGH ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE DEVELOPMENT IN OYO METROPOLIS NURSERY SCHOOLS, OYO STATE, NIGERIA

Oladapo Johnson Olayanju (Ph.D)

Department of Educational Foundations and Curriculum Studies
Faculty of Specialised and Professional Education
Emmanuel Alayande University of Education, Oyo, Nigeria
johnsonyanju@gmail.com

Abstract

This study investigated nurturing excellence in early childhood education through artificial intelligence for sustainable development in Oyo metropolis nursery schools, Oyo State, Nigeria. The conceptual framework on which the paper is hinged centered on Technology Acceptance Model and Rogue Agent Sustainable Model while Theoretical model adapted was Montessori Theory: The key principles in educating the children is adopted for the paper. The study adopted mixed research method of data collection through content and documentary analysis. The paper highlights the following concepts: Early Childhood Education, Artificial Intelligence (AI); Sustainable Development and Oyo Metropolis. In this study, the review of related literatures was thematically presented thus: Artificial Intelligence, Early Childhood Education (ECE); importance of ECE for Sustainable Development, the objectives of Early Childhood Education as stipulated in National Policy on Education in Nigeria (FRN, 2014) were clearly stated. The concept of sustainable development, seven principles Montessori education in classroom setting, Strategies for Nurturing Excellence in Early Childhood Institutions through Artificial Intelligence were equally examined. Findings of the paper revealed that integrating Artificial Intelligence into nursery education in Oyo Metropolis, Oyo State, Nigeria has acted as impetus for nurturing excellence in early childhood pedagogical delivery in the basic level of education in Nigeria. In addition, the introduction of artificial intelligence has motivated teachers and encouraged parents through innovative and transformative education noticeable in the behaviours of learners. Based on the discussions of the paper it was recommended that a conscious effort should be made by balancing the use of artificial intelligence technology and the real-world interaction. Over reliance on AI technology by pupils should be discouraged. There is need for a regulatory policy on the application of AI in Nigerian schools to direct and safeguard its use by bringing sanity into Nigerian education system.

Keywords: Artificial Intelligence, Early Childhood Education, Nurturing Excellence, Oyo Metropolis, Sustainable Development and Technology Acceptance Model.

Introduction

AI can contribute to a richer, more evidence-informed policy and planning environment in education. The examples presented herein show how learning analytics platforms can use predictive algorithms to help teachers diagnose and anticipate learning difficulties faced by learners and thus implement personalized interventions to respond to those difficulties. However, while predictive algorithms certainly facilitate data analysis and interpretation, these algorithms are not what make learning analytics systems powerful. The effectiveness of learning analytics systems lies in their usefulness and relevance to learners and educators.

Education plays a critical role in efforts to make future workforces AI-ready. Bridging the AI skills gap goes beyond the adoption of increasingly powerful technologies to facilitate learning. It also means rethinking the content and methods used to deliver instruction at all levels of education. The aim of integrating Artificial intelligence into education is an attempt to introduce skills that would allow learners to identify and solve problems using computing techniques, methods and technologies.

Early Childhood Education is a starting point for a child's development and a key foundation of a sustainable educational system. It is a crucial period of brain development of a child and the root formation of individual potential. Early childhood education is faced with the challenges of the use of the language of the immediate environment as a medium of instruction beyond the primary six levels although the National Policy on Education stipulates that children should be taught the language of their immediate environment from pre- nursery to basic three while English Studies is offered as a subject. In line with the above assertion Olayanju (2024) maintain that low implementation of the use of language as a medium of instruction is not implemented in the southwestern part of Nigeria.

Early Childhood Education is an essential formal education given to children from conception to eight years for cognitive, social, and emotional development, language and speech development, and the development of fine and gross motor skills. Early childhood education reduces the rate of school dropout and higher school achievement and helps to curb the rate of juvenile arrests in society. However, early childhood education is faced with a lot of bottlenecks that intend to hinder the effectiveness of early childhood in Nigeria (Olayanju, 2018). These challenges comprise poor infrastructure facilities, poor numeration of teachers' salaries, inadequate implementation of early childhood curriculum, employment of unqualified and incompetent teachers with little or no in-depth knowledge of early childhood Developmental Appropriate Practices, corruption, and poor funding of early childhood programs. Proliferation of early childhood according to National Policy on Education is a pertinent issue that has led to a poor standard and lack of proper regulation of early childhood institutions across the country, the language of the immediate environment as a medium of instruction is not strictly adhered to most states in Nigeria among others.

However, Dignum (2021) and Hwang et al., (2020) make a lucid clarification on the evolution of AI into educational sub-sector that concept AI remained limited to the field of computer science only. Later the concept of AI in education evolved as the integration of AI into the education management system which facilitates teaching, learning, and decision-making, as well as providing virtual assistance for personalized education AI can further enable providing individual customized learning for students thus facilitating the learning needs. Educators can deliver the learning content to the students using AI-based technologies such as cloud computing to students in a format and form suitable for various student needs. AI can also provide an opportunity for students to interact with Chatbots thus enhancing their learning and clearing any confusion resulting in facilitating independent learning (Chen et al., 2020).

Historical Antecedents of Artificial Intelligence Package into Nigerian Education System

The use of AI in the field of Education can be traced back to the 1970s when LOGO programming and Turtle robots were introduced to young learners. However, those tools focused more on computational thinking or programming concepts instead of AI. In 1995, *Artificial Intelligence: A Modern Approach* was published and is considered the most standard textbook in the field of AI for computer science undergraduates (Russell and Norvig, 1995). Accordingly, computer science university students could learn how AI can solve problems, reason, learn, make decisions, communicate, perceive, and act (Russell and Norvig, 1995).

Miao and Shiohira, (2021) reported that eleven countries around the world have incorporated AI into their STEM/computing curricula to promote competitiveness and equip young people for the future workplace. AIK12 (2019) proposed the “five big ideas” about AI that serve as the framework to uncover the necessary AI concepts that students in each grade level should learn. The five big ideas include perception, representation and reasoning, learning, natural interaction, and the societal impact of AI (AIK12, 2019). The ISTE (2022) further designed an AI project guideline and proposed seven standards to prepare students to become (1) empowered learners, (2) knowledge constructors, (3) computational thinkers, (4) innovative designers, (5) digital citizens, (6) creative communicators, and (7) global collaborators. Overall, currently, AI is becoming the next big trend in the education field at all levels including primary, secondary, as well as higher-level studies.

Since its ‘birth’ at the 1956 Dartmouth Conference, the field of artificial intelligence (AI) has continued garnering the interest of a and industries alike. Few technological developments in recent history have been as polarizing as AI. While AI has been around for nearly 60 years, it nevertheless remained a fringe technology until only recently because of sweeping changes in recent years (referred to as “the big leap”), entailing the abundance of data (big data), economic access to computing power and advances in Machine Learning.

This framework was created to contribute in the vision of teacher training to face the challenge of teaching in finally, another framework is DigComp (Joint Research Centre, 2018), designed by the European Union to support the development of digital skills of individuals. The framework describes what competencies are needed today to use digital technologies in a critical, reliable, collaborative and creative way, so that individuals can achieve their goals related to work, learning, leisure, inclusion and participation in the digital society.

At present, two distinct communities have evolved, namely learning analytics (LA) and Educational Data Mining (EDM). These two communities significantly overlap in terms of objectives and techniques, but they differ in that EDM researchers, originating from the community of intelligent tutoring systems, work on very small-scale cognition. EDM methods are drawn from a variety of disciplines, including data mining, machine learning, and psychometrics of statistics, information visualisation and computational modelling.

Objectives of the Study

In the context of a near future society empowered by Artificial Intelligence (AI), it is important to develop new skills to create and decode digital technologies. To approach this topic, we will focus on new frameworks that characterise digital skills for students and teachers and some cases from different countries in other to abreast us about the development of AI globally and lessons from this will accelerate nurturing excellence in ECE through AI for sustainable development in Nigerian Nursery Schools. The objective is to reveal the power of digital competencies that can analyse, use and decodes Artificial Intelligence as a powerful technological Innovation in Nigerian education. An objective of this paper therefore, is to investigate nurturing excellence in early childhood education through artificial intelligence for sustainable development in Oyo metropolis nursery schools, Oyo State, Nigeria. Thus the study aims at the following:

1. To highlights the impact of Artificial intelligence package and strategies or mechanisms put in place in nurturing excellence in early childhood education in Nigeria.
2. To identify the objectives of early childhood education as stipulated in the National Policy of Education in Nigeria and the extent to which these objectives were been met.
3. To ascertain the extent to which the postulations of Montessori on early childhood education has transformed the pedagogical delivery in Nigerian Nursery Schools

4. To identify the challenges posed with the introduction of artificial intelligence package and proactive measures to overcome these challenges in Nigerian Nursery Schools.

Statement of the Problem

Children from affluent families are far more likely to have access to AI-driven educational resources due to their families' ability to afford private schools equipped with advanced technology. These schools often have the infrastructure, funding, and trained staff to integrate Artificial Intelligence tools into their teaching practices. To this end, pupils in such environments benefit from personalized learning experiences, access to cutting-edge technology, and enhanced educational content, giving them a significant advantage in terms of skill development and readiness for future opportunities. In contrast, children from low-income families many of whom attend public schools or community-based learning centers rarely have access to AI tools or even the basic infrastructure required to support such technologies Pansoni et'al, (2023).

Lastly, there is insufficient research before 2021 to support the development of theoretical frameworks for the teaching and learning of AI. It is against this backdrop that the author has decided to investigate in-depth nurturing excellence in early childhood education through Artificial Intelligence for sustainable development in Nursery and Primary School in Oyo Metropolis, Oyo State, Nigeria.

Research Questions

The underlisted questions were raised to give the paper a focus

1. Of what significance is the introduction of Artificial intelligence package and strategies or mechanisms employed in nurturing excellence in early childhood education through artificial intelligence in Nigerian Nursery Schools are accomplished?
2. State the objectives of early childhood education as stipulated in the National Policy of Education in Nigeria and the extent to which these objectives were been met
3. How far has the educational ideas and theory postulated by Montessori on early childhood education has nurtured excellence in the pedagogical delivery in Nigerian Nursery Schools?
4. What are the challenges posed with the introduction of artificial intelligence package and practical measures put in place to overcome these challenges in Nigerian Nursery Schools?

Methodology

The study adopted mixed research method of data collection through content and documentary analysis. Content analysis is a scientific research technique used extensively in social studies in recent years it is a more structured process that guides content analysis using a directed approach than a conventional system. The content analysis method demonstrated the most used technology acceptance models worldwide. The study was a documentary analysis of virtual document stored electronically for access through the internet, textbooks archival, repository as well as encyclopedia and was able to reveal that despite attitudinal and technical challenges, mobile technologies are receiving acceptance as useful resources for all pedagogical practices

Population of the Study: The Study was carried out in the ancient town of Oyo and its environs which constitutes Oyo Metropolis comprises four local government areas viz: (Afijio, Atiba, Oyo East and Oyo West).

Sample: The sample for the study consist of two (2) early childhood institutions selected from each of the four (4) local government areas (making eight (8) early childhood institutions. The Selected early child institutions as listed in the appendix:

Conceptual Framework

Early Childhood Education

The Federal Republic of Nigeria in National Policy on Education (FRN) states that ECCDE is the care, protection, stimulation, and learning given to children aged 0-4 years in a crèche or nursery. Some reports defined early childhood education as a holistic education that enhances pupils' potential for survival in future careers. Universal Basic Education Commission describes early childhood education as a care protection and stimulation center aimed at enhancing learning in children from zero to five years. Obidike (2012) asserts that early childhood education is a type of education given to children below the official school- age mainly to prepare them for primary education.

Furthermore, Early Child Education is also known as Early Childhood Care and Education (ECCE), Early Childhood Care and Development Education (ECCDE). Early childhood is not only a crucial period in the life of children but also a very significant stage in a child's life. It is a period of rapid brain development of individual children which takes place between 0 to 6 years (0- 6 years), during this period a child has the same brain as that of an adult (Olayanju, 2024).

Early Childhood Education is defined as a period of linguistic, cognitive, social, and emotional development that determines human potential in the future. National Association for the Education of Young Children (NAEYC) and Education for Early Years (EYE) saw early childhood Education as a type of formal education given to children between the ages of zero to eight years old (0-8years). The implication of this is that early childhood education extends from crèche to primary three. Some reports defined early childhood education as a process designed by professionals to provide holistic development in children from birth to before middle childhood. Early Childhood Education is education provided for children below the official age of primary education. Akinrotimi and Olowe (2016) in their submission conceived that Early Childhood Education is the education given to children from birth to eight years, which enhances intellectual, socio-emotional, language, and physical development in children while Nakpodia (2011) describes Early Childhood Education as a formal education given to children from age one to five-plus before entering into the primary level of education. Classify early childhood into Creche, Day- care, Playgroup, Nursery, and Kindergarten in Nigeria.

Artificial Intelligence (AI)

The concept of Artificial Intelligence (AI) is gradually making its way into the education field. Initially, it was known as AI literacy which refers to the ability to understand, use, monitor, and critically reflect on AI applications without necessarily being able to develop AI models themselves (Long and Magerko, 2020). The term AI was first used in an online article in 2015 (Konishi, 2015). The term joins a long line of proposed literacies intended to symbolize the understanding of a particular technological construct, like "media literacy" or "data literacy" (Wolff, Gooch, Montaner, Rashid, and Kortuem, 2016). Artificial Intelligence Literacy encompasses AI competencies that the general population should possess and accordingly focuses mainly on learners without a computer science background ("non-experts").

The role of AI in education is increasing as evident from global initiatives (e.g., ISTE, UNESCO, DigComp) which started to conceptualize AI education according to the latest educational standards and design guidelines to address digital literacy levels across the globe (DigComp, 2022; ISTE, 2022; Miao and Shiohira, 2021). These frameworks represent different perspectives on the idea of AI education.

Long and Magerko (2020), Artificial Intelligence Literacy is a set of competencies that enables individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and use AI as a tool online, at home, and in the workplace (Long and Magerko, 2020),.

Sustainable Development

Sustainable Development is a development which will satisfy the needs of the present time without using generations' abilities for fulfilling their needs (Connelly & Smith, 1999). Sustainable Development is a process by which the people of a country satisfy their own needs and improve their lives without utilizing the resources that belong to the future generations and wasting future wealth to provide their immediate demands. Sustainable development is based on the sustainability philosophy. Sustainability refers to the ability of the system to function in the unlimited future. It is a situation in which the desirability does not diminish over time and the resources that human system (Zahedi, 2019).

Theoretical Framework

To advance the field of AITL, recent researchers have started to develop more theoretical frameworks (Long and Magerko, 2020) to guide educators in creating lesson designs that offer the most appropriate pedagogies and teaching tools for each AI training goal Compliance.

Technology Acceptance Theory

The model introduced by Davis (1989) is the most widely used in information system research for its relevance and appropriateness (Alzubi et al., 2018). TAM is an adaptation of the theory developed by Fishbein and Ajzen (1975). TAM is a model which describes the causes of acceptance of computers which includes the five essential constructs viz: Actual Use (A), Attitudes Towards Using (A), Behavioural Intention (I), Perceived Ease of Use (PEAU) and Perceived Usefulness (PU) (Rodrigues et al., 2016). TAM is adapted from Theory of Reasoned Action (TRA), which discovered two strong beliefs; PU and PEOU. These beliefs are known as the determinants of attitude towards using informational technologies and usage intention Taylor & Todd (1995). To handle information technology behavioral usage and intentions (Davis et al., 1989), researchers use TAM as both PU and PEOU are significantly crucial in predicting the users' behavior on the recognition of technologies (Camilleri & Camilleri, 2019). Figure 1 shows the relationship between these two beliefs.

The suggested framework, shown in Figure 1, for AI's roles in Education for Sustainable Development (ESD) encompasses INPUT, OUTPUT, and AI's converters. Prioritizing educational access and completion, AI enhances efficiency and effectiveness by aiding teaching, learning, and administration. For low-income and lower-middle-income countries, the focus lies on basic education access and quality.

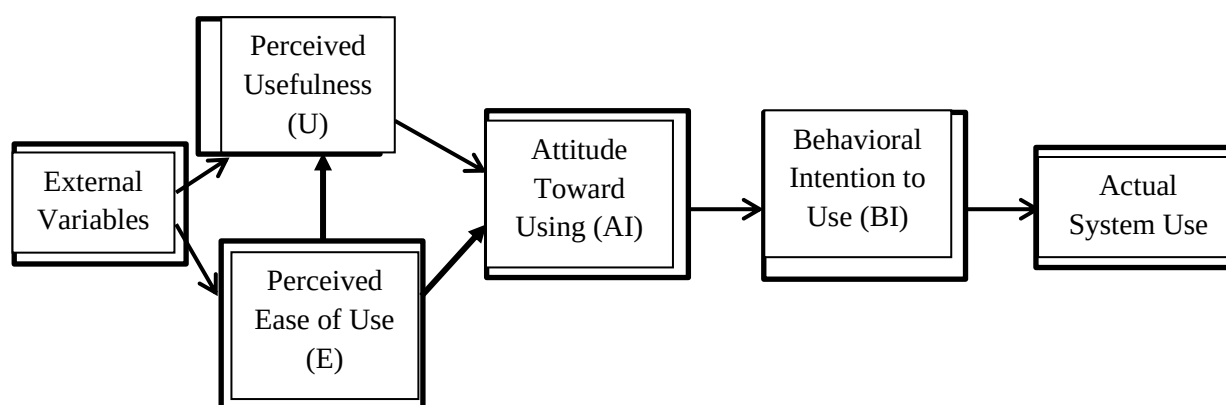


Figure 1: Technology Acceptance Model

Source: Davis 1986, Technology Acceptance Model Propped by Fred Davis Adopted by Olayanju 2025

TAM aims to provide a parsimonious explanation of the determinants of adoption of technology user behavior information on accepting the use of information technology itself (Davis, 1989). TAM focuses on using information technology by developing it based on the perception of usefulness (Perceived Usefulness) and ease (Perceived Ease of Use) in information technology (He et al., 2018). The perception of usefulness is how a person believes that using a particular system will improve his work performance. In contrast, the perception of ease refers to the degree to which a person believes that using a particular system will make his efforts lighter (Davis, 1989) as in the present study whereby AI package used to nurture excellence in Early Childhood education through sustainable development in Nigerian nursery schools

Pikkarainen et al (2004) defined the Technology Acceptance Model (TAM) as a model that explained the majority of variance (about 40%) in the importance and behavior of information systems. According to Marwanto (2019), the acceptance technology (TAM) model is consumers' information technology. The technology acceptance model, commonly referred to as the Technology Acceptance Model (TAM), is commonly used to predict consumer acceptance of new technology. Davis (1989) describes Perceived Usefulness as an individual's belief to perform a particular system to upgrade their work performance and Perceived Ease of Use. TAM believes that the uses of computers are influenced by the Behavioural Intention to Use of the system. In contrast, the function of joint intention depends on an individual's attitude towards the usage of the system and opium use.

Rogue Agent Sustainable Model

In society, many resources are entrusted to agents or custodians who have a duty to manage and utilize the resources in their custody for the greater good of society and the environment (Shackleton, 2009; Burns, 2016). The agents or custodians can be given perverse incentives to use the resources in their custody to pursue their own self-interests rather than the greater good of society and the environment (Gergen, 1987; Mazzolini and Celani, 2020). In the present study nursery schools are been managed and utilized. Accordingly, the rogue agent theory states that those responsible for managing existing resources, as well as those who have been entrusted to utilize resources on behalf of others, may have perverse incentives to use the resources in their custody in a self-serving manner, irresponsible manner.

Justification for using Rogue Agent Sustainable Model

The theory advocates that mechanisms should be put in place to ensure that those responsible for managing existing resources, and those who have been entrusted to utilize resources on behalf of others, do not go rogue. In other words, mechanisms, checks, and balances should be put in place to ensure that they use the resources in their custody in a way that is sustainable, responsible and beneficial to people, society and the environment. The rogue agent theory of sustainable development has several merits. In the first place, the theory acknowledges that agents manage existing resources on behalf of others like early childhood institutions. Secondly, the theory acknowledges that existing resources can be used for good and for bad purposes. Thirdly, the theory states that agents are responsible for the sustainable or unsustainable use of the resources they are entrusted with. Fourthly, the rogue agent theory also points out that agents can be influenced by perverse incentives which mean they can be influenced to use the resources in their custody in ways that are detrimental to people, society, and the environment. Fifthly, the theory aligns with reality because many societies already have accountability mechanisms, checks and balances in place to ensure that the people responsible for managing existing resources, as well as those who have been entrusted to utilize resources on behalf of others, use the resources in a way that is sustainable like teaching pupils in Nigerian nursery schools, head teachers, inspectorate of education, rules and regulations emanating from the federal and state ministries of education.

Benefit of Artificial Intelligence Package in Nigerian Nursery Schools

The concept of AI is about the combination of applications of machine learning, deep learning, algorithm production, and natural language processing (Akgun and Greenhow, 2022). AI is beneficial for organizations and individuals as it can increase efficiency, productivity, save time and effort, and improve overall performance (Ali, Abdelbaki, Shrestha, Elbasi, Alryalat, and Dwivedi, 2023; Flavian and Casalo, 2021). Overall, AI is permeating more and more areas of our daily lives, and is increasingly being used in professional contexts such as education (Chen, Chen, and Lin, 2020; Hwang, Xie, Wah, and Gašević, 2020); healthcare delivery (Matheny, Whicher, and Israni, 2020).

The benefits of AI in education include greater flexibility in terms of time and space and a changing role of the tutor as a facilitator. The discussed key challenges including ethical issues such as data privacy, lack of inclusion and equity for students of all backgrounds, and lack of human touch. Based on these themes we concluded that AI's role in education will increase in the future, but the challenges also need to be addressed to fully unlock the benefits of AI in the education field.

Benefits of AI in the Education Field The general benefits of AI such as efficiency and customization also apply to AI in education. The main benefit of AI in education is that it can facilitate learning with greater flexibility and convenience as learners can learn in their own time and space using AI-related infrastructure (Kabudi et al., 2021; Tahiru, 2021). Along with flexibility, AI can also enhance accessibility to education.

AI can also enable tutors to empower their students' AI competencies, attitudes, and readiness to communicate with other learners, solve authentic problems, and develop ideas, theories, and solutions innovatively and collaboratively (ISTE, 2022). Thus, the use of AI in education is resulting in overall improvement of the student's performance.

Other benefits of AI includes greater support available to students (Baidoo-Anu and Ansah, 2023). For example, AI-based assistance to students uses Chatbot and virtual assistants which are based on intelligent systems and can offer round-the-clock availability, address queries, and offer valuable feedback. AI also enables enhanced engagement and motivation of students by providing tools such as gamification of learning or interactive content. It enables students to be more engaged and motivated (Zhang and Aslan, 2021).

The automation of assessment is shifting the role of the teacher to a facilitator (Holmes and Tuomi, 2022). Teachers can integrate AI lessons as supplementary materials to assist weak students and provide hands-on experiences in the form of human interaction for students. AI systems also provide students with a judgment-free environment of learning and can suggest solutions to improve students' performance.

The reduced cost thus can be transferred to other stakeholders such as students. Overall, we can argue that AI use in the education field has benefits for learners, tutors, and educational institutes in terms of flexibility, increased learning, a focus on more important tasks, and increased efficiency.

AI can help advance collaborative learning. One of the most revolutionary aspects of computer-supported collaborative learning is found in situations where learners are not physically in the same location. Based on AI techniques such as machine learning and shallow text processing, AI systems are used to monitor asynchronous discussion groups, thus affording teachers with information about learners' discussions and support for guiding learners' engagement and learning.

Provisions of the National Policy on Education on Early Childhood Education in Nigeria Early Child Care Development and Education

Early child Care Development and Education (ECCDE) is the care, protection, stimulation and learning promoted in children from 0 -4 years in a crèche or nursery.

According to the National Policy on Education (FRN, 2014) the objectives/purpose of Early Child Care Development and Education shall be to:

1. Effect a smooth transition from the home to the school;
2. Prepare the child for the primary level of education;
3. Provide adequate care, supervision and security for the children while their parents are at work;
4. Inculcate social, moral norms and values;
5. Inculcate in the child the spirit of enquiry and creativity through the exploration of nature, the environment, art, music and the use of toys. etc;
6. Develop a sense of co-operation and team-spirit;
7. Stimulate in the child good habits. Including good health habits; and
8. Teach the rudiments of numbers; letters, colour, shapes. Forms, etc. through play.

Ways in which Montessori Theory on early childhood education nurturing excellence in the pedagogical delivery in Nigerian Nursery Schools?

The Montessori theory, developed by Maria Montessori in the early 20th century, has gained global recognition as an effective pedagogical approach in early childhood education. Its principles of child-centered learning, independence, and hands-on activities align with contemporary educational goals, particularly in preparing teachers to foster sustainability in education systems. This paper justifies the adoption of the Montessori theory in early childhood

education as a strategy for promoting sustainability in teacher preparation within the Nigerian educational system.

Montessori classrooms recognize the importance of play and social interaction. Children are given time to engage in imaginative play and social activities. This helps to promote social and emotional development. The Montessori theory is an effective way to provide children with a stimulating and supportive learning environment. Applying Montessori theory allows children to develop a sense of autonomy and independence.

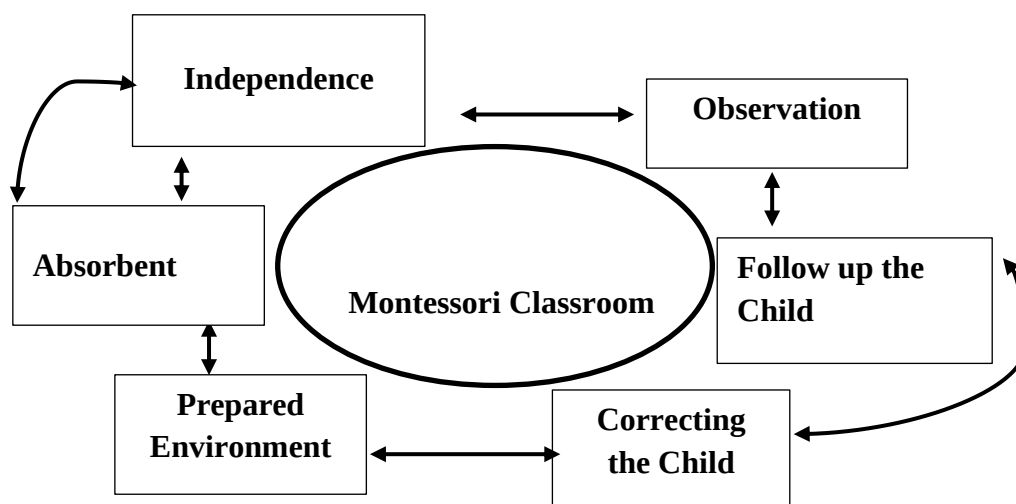
Theoretical Model: The Key Principles in Educating the Children

1. Independence: **“Never help a child with a task at which he feels he can succeed.” – Maria Montessori.** It is always a goal of Montessori education in the classrooms to make the child independent and be able to do things for himself. This is achieved by giving children opportunities. Opportunities to move, to dress themselves, to choose what they want to do, and to help the adults with tasks.
2. Observation: Observation, or watching the child is for parents easy to do. We can spend countless hours just watching children and see how they are enjoying themselves, exploring their environment. This was the simple method of how Maria Montessori has learned about children and developed her theories on child development. She observed without preconceived ideas that helped her develop materials that the children needed and were interested in. Observation is also the way adults can learn about what the child needs are.
3. Following The Child: Follow the child, they will show you what they need to do, what they need to develop in themselves and what area they need to be challenged in. The aim of the children who persevere in their work with an object is certainly not to “learn”; they are drawn to it by the needs of their inner life, which must be recognized and developed by its means.” – Maria Montessori. From what you have observed from the actions of the children, follow them in what they need to do. If they want to climb, give them the opportunity to climb in a safe manner, do not be overprotective. Following the child also means being non-directive, do not tell them what to do all the time. Give your child the freedom to choose what he wants or needs to do and to act on his own.
4. Correcting The Child: Children make mistakes. They may spill something, drop food unintentionally and so on. There is no need to raise your voice in situations like those. Instead, calmly recognize the mistake “oh you’ve spilled the water..., why don’t we get a cloth and wipe it up.” This is an opportunity to ask the child to do some valid practical work with you. Children will make mistakes and we need to teach them in a nice manner. Giving the children freedom and choice, supporting them in their choice by making sure they are safe, feeding their inquiring minds in a way that they can understand and observing their needs and fulfilling these can be the key to helping your children develop their full potential.
5. Prepared Environment: “The teacher’s first duty is to watch over the environment, and this takes precedence over all the rest. It’s influence is indirect, but unless it be well done there will be no effective and permanent results of any kind, physical, intellectual or spiritual.” Montessori refers to work as an activity the child does or what many people might call play. She calls this work since it is through this that they create themselves and it is not just a play. Their play is their work and they are still enjoying it. The adult’s role then is to construct the

environment in which they will learn. The development of the child is therefore dependent on the environment she or he is in, and this environment also includes the parents.

6. Absorbent Mind: Montessori observed how children learned the language without anyone teaching them. This sparked her idea for the “absorbent mind”. Children under the age of three, do not need to have lessons in order to learn, they simply absorb everything in the environment by experiencing it, being part of it. It is therefore important that the environment set up is good, nice and positive since this is what the child will absorb whether he chooses to or not. The language of the adult is one that a child will easily pick up. Be careful of what you say around them. Even though you think they are not listening, as they may not be able to express themselves yet, when they can you will not want them swearing back at you. It is for this reason that one should not try to say “No” to a child. We do not want them saying “No” to us rudely. Instead, we say “Stop” when we want to tell children that what they are doing is wrong.
7. Montessori Classroom: The teacher acts as a guide, offering assistance and support when needed. Montessori classrooms are often multi-age, allowing children of different ages to work together and learn from each other. This is seen as beneficial, as older children can help younger children with activities and the younger children can interact and learn from the older children.

Montessori classrooms recognize the importance of play and social interaction. Children are given time to engage in imaginative play and social activities. This helps to promote social and emotional development. The Montessori approach is an effective way to provide children with a stimulating and supportive learning environment. Applying Montessori theory allows children to develop a sense of autonomy and independence.



Source: Olayanju, 2025

Challenges of Artificial Intelligence Package in Nigerian Nursery Schools?

Despite many benefits, AI has challenges such as data security, confidentiality, and causing unemployment. The challenges of early childhood education as a shortage of trained teachers, lack of adequate infrastructure, shortage of instructional materials, poor remuneration of teachers' salaries, and lack of adequate funding.

Inadequate Infrastructure: Infrastructural facilities have been conceptualized by Ogunode (2020a) as those facilities aiding the delivery of services in educational institutions. The

availability of the infrastructural facilities in adequate quantities will support effective administration of educational institutions and the inadequacies will prevent effective administration of educational institutions. Many schools, especially in rural areas, lack the necessary infrastructure, such as reliable electricity, internet connectivity, and digital devices, to support AI implementation. This creates a barrier to adopting AI technologies. The importance of infrastructural facilities in educational institutions.

Lack of Skilled Professionals and Low Digital Literacy among Caregivers: There is a noticeable shortage of professionals with specialized training in artificial intelligence (AI) and its applications in education, which poses a significant challenge to the effective integration of AI into the Nigerian basic education system. Skills gap hampers the ability to develop, deploy, and maintain AI systems in schools, ultimately limiting their potential impact on teaching and learning. Without trained experts, schools struggle to utilize AI solutions tailored to local needs, leading to suboptimal outcomes. Furthermore, a considerable number of educators and caregivers, particularly in Early Childhood Education (ECE) and basic education generally lack the necessary skills to use AI tools effectively. This deficiency in digital literacy among teachers is a significant barrier to the successful adoption of AI technologies in classrooms. Teachers who are not well-versed in using digital and AI-driven tools are less likely to incorporate them into their teaching practices, which limits students' exposure to innovative learning methods and hinders progress in modern education. Edinoh, (2023).

High Cost of Implementation and Shortage of Instructional Materials: Implementing AI requires significant investment in software, hardware, and maintenance. Many basic education centers in Nigeria operate with limited budgets and may find it challenging to afford these technologies. Ogunode and Josiah (2023) defined instructional materials as educational resources assembled by the teachers to implement teaching programmes in the classroom.

Poor Funding: Early Childhood Education has been characterized by poor funding as one of the major challenges. Jacob and Samuel (2020) affirms that early childhood education has not been adequately funded from 1999 up till 2014 with a budgetary allocation of less than 12% for every fiscal year. According to Ogunode and Agwor (2021) shortage of funds hampered effective implementation of the programme as gadgets and internet connection as well as other digital devices are indispensable prerequisites for effective and efficient deployment of artificial intelligence learning activities.

Cultural Adaptation and Traditional Resistance: Nigeria is a cultural nation. Cultural and traditional mindsets in some communities may resist AI adoption, viewing it as a threat to conventional teaching methods or as a technology that could dehumanize education. The universal access and top-down approach which is one of the sector-specific principles developed for AI in cultural heritage is meaningful participation, Pansoni et'al, (2023). This prescribes that the use of AI technologies should be implemented in an inclusive manner through a bottom-up approach involving different stakeholders and competencies Pansoni et'al, (2023). Many contend that cultural heritage digitization is frequently adopted top-down and as a means rather than an aim, omitting several vital aspects of the community's needs. As Taylor and Gibson (2016) argue certain digitization activities can subtly reinforce non-democratic structures. For example, this might be the case of digitizing the cultural heritage of indigenous communities. This would ask for both hearing and centering their voices and considering the consequences that such operation (i.e., the resulting free access to that heritage) would bring to the target community.

Equity and Accessibility Challenges: One of the most pressing challenges in implementing basic education in Nigeria, particularly in integrating artificial intelligence (AI), is the issue of equity and accessibility. Socioeconomic disparities play a significant role in determining which children can access the benefits of AI-driven educational tools and platforms. These disparities often lead to unequal opportunities for learning, further entrenching educational inequalities in the country, Taylor and Gibson (2016). Children from affluent families are far more likely to have access to AI-driven educational resources due to their families' ability to afford private schools equipped with advanced technology. These schools often have the infrastructure, funding, and trained staff to integrate AI tools into their teaching practices. Many public schools in Nigeria lack stable electricity, reliable internet connectivity, and functional computer systems, all of which are prerequisites for implementing AI in education. Without access to these resources, children in remote communities are left at a significant disadvantage, unable to reap the benefits of modern educational advancements. This disparity has far-reaching implications.

The proliferation of early childhood institutions: The National Policy on Education recognizes the importance of Early Childhood Education in Nigeria. The proliferation of early childhood according to National Policy on Education is a pertinent issue that has led to a poor standard and lack of proper regulation of early childhood institutions across the country.

Inadequate Monitoring and Supervision: Inadequate monitoring and supervision are seen as another bottleneck experienced in early education in Nigeria. Some report posits the need for adequate supervising and proper monitoring of early childhood centers for regular implementation of early childhood programs. On the hand, Sooter (2013) affirms that early childhood centers in Nigeria are not properly and adequately supervised. Supervision as an indispensable implementation key of any given organization. lack of implementation on the teacher-to-pupil ratio. National Policy on Education stipulates that one teacher is expected to teach a maximum of twenty-five pupils in a class but reversed is the case in Nigeria's Early Childhood classroom, especially in government-owned schools.

Practical Measures put in place to overcoming the challenges of Artificial Intelligence Package in Nigerian Nursery Schools?

Public-private partnership is an indispensable ways of strengthening AI training and research. Many advanced countries of the world had forged partnerships between industry and academia not only to share material and financial resources and more importantly they ensure that educational programmes are well aligned with labour market needs. Partnerships should not be limited to industry and academia, though; intra-sector partnerships prove just as important as academia-industry partnerships. Partnerships between universities and research institutes foster collaborative research, that accelerate the development of expertise in AI. Thus nurturing excellence in ECE through artificial intelligence for sustainable education in Nigerian nursery schools needs to be considered as good investment in education.

However, Olaleye and Otomayo (2009) assert that some recent factors have relatively brought early childhood education to the forefront of public awareness. These factors include the fundamental changes in the economy of the country and its impact on family life, rising cost of living, emergence of a single-parent household, increased number of teenage parents, decrease in the impact of the extended family, and the call by many professionals who advocated for the right of children. These recent phenomena no doubt stressed the need for quality early childhood education. Therefore, early childhood education is an effective tool that will provide a good start in life.

A clear understanding of how AI-enabled systems can facilitate learning provision, so that they can make sound value judgments on new AI-enabled educational products. Research and data analytical skills, so that they can interpret data provided by AI-enabled systems, ask useful questions about the data and provide students with feedback based on insights that arise from the data; and New management skills, so that they can effectively manage both human and AI resources at their disposal.

A critical perspective on the ways Ai and digital technologies affect human lives and new frameworks of computational thinking and digital skills can increment students' capacities to understand the power, the dangers and the possibilities of AI. Enable teachers to take advantage of AI taking over repetitive tasks to bring in more human capabilities they may not have had time for before: mentorship, emotional support, interpersonal skills, etc.

Help learners acquire those skills and competencies that are likely not to be replaced by machines.

Recommendations

Based on the discussions of this paper the following recommendation were made

1. Federal government of Nigeria should endeavour to put the following in motion in order to actualize the desirable goal of nurturing excellence in ECE through Artificial intelligence for sustainable development
2. The use of English as a medium of instruction should be introduced in nursery school to enhance unhindered pedagogical delivery of Artificial Intelligence (AI) packages that help children in reading, speech and communication skills.
3. Teachers should be trained and retrained on new trends in early childhood.
4. Government should increase funding for early childhood education because it is a basic rock for other levels of education.
5. Make provision for the production and effective utilization of learning and instructional materials in adequate numbers; and Ensure that the medium of instruction is principally the mother – tongue or the language of the immediate community; and as a matter of urgency Develop the orthography of, more Nigerian languages; and more importantly Produce relevant and standard supplementary readers and other instructional materials on Nigerian languages. On Early Childhood Education Curriculum
6. Early childhood specialists should be included in the education policy making.
7. There should be adequate monitoring and supervision by the ministry of education and Setting up minimum standard for ECCDE centres.
8. Develop and disseminate curriculum materials such as the Integrated Early Child Care Development (ECD) Policy, National Minimum Standard for the establishment of Early Child Care Education Centers. IECD Curriculum, IECD Implementation Guidelines and all other materials that will enhance the implementation of ECCDE;
9. Encourage both community and private efforts in the establishment of ECCDE centres based on set standards;
10. Make provision in teacher education programmes for specialization in early child care and education, and for retraining of teachers;
11. Ensure that the curriculum of teacher education is oriented towards play-way method by adapting the following, Ensure that ECCDE Centres adopt the following caregiver/infant rations: (i) Creche 1:10; (ii) Nursery 1:25; Develop suitable ECCDE curriculum for nationwide implementation;

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THE PERCEIVED ROLE OF ARTIFICIAL INTELLIGENCE IN SUPPORTING INCLUSIVE EDUCATION FOR SUSTAINABLE DEVELOPMENT IN OYO STATE, NIGERIA

Amos Ayoola Odeleye

Emmanuel Alayande University of Education, Oyo

odeleyeamos@gmail.com

Abstract

In an era of rapid technological advancement and a global commitment to equitable education, AI offers opportunities to enhance teaching, personalize learning, and increase accessibility for diverse learners. This study investigates the perceived role of Artificial Intelligence (AI) in supporting inclusive education for sustainable development, focusing on how various stakeholders interpret and engage with AI-driven tools and systems. The study employed a descriptive survey research design, utilizing a sample of 200 secondary school teachers from four local government areas in Oyo State, selected via simple random sampling. Data was collected using two instruments: the "Disposition of Teachers towards Achieving Sustainable Development Goals through Inclusive Education Questionnaire" (DTASDGIEDQ) and the "Perception of Teachers on the Role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development" (PTRAISIESDQ). Both instruments were validated by experts and demonstrated reliability with Cronbach's alpha indices of 0.78 and 0.85, respectively. Descriptive statistics (mean, standard deviation, frequency count, simple percentage) were used to answer research questions, while inferential statistics (T-test and ANOVA) were employed to test hypotheses. Findings reveal a "positive" disposition among teachers towards achieving SDGs through inclusive education, with a Weighted Average Mean of 3.3. However, a "mixed or less consistently positive perception" was noted regarding AI's direct impact on improving equitable access for disadvantaged students, with a mean of 2.19. The study found no significant difference in teachers' perceptions based on gender or educational attainment. The study concludes that while teachers are optimistic about inclusive education for sustainable development and see AI as a supportive tool, addressing equitable access and ethical AI development is crucial for its effective and inclusive integration in education

Keywords: Artificial Intelligence, Inclusive Education, Sustainable Development, Teacher Perception, Educational Technology.

Introduction

In an era marked by rapid technological advancement and a growing global commitment to equitable education, the integration of artificial intelligence (AI) into educational systems has emerged as a transformative force. AI offers novel opportunities to enhance teaching, personalize learning experiences, and increase accessibility for diverse learners. Simultaneously, the global education agenda—anchored in the United Nations' Sustainable Development Goals (SDGs)—places strong emphasis on inclusive and equitable quality education (SDG 4) as a foundational element for sustainable development (United Nations, 2015). AI is broadly utilized and considered a powerful tool to enable and enhance teaching and learning. Holmes, Bialys and Fade (2023) as well as Hwang, Xie, Wah, and Gašević (2020) suggested that it is also essential for instructional design, technological development, and educational research.

Inclusive education, which ensures that all learners, irrespective of their backgrounds or abilities, have access to meaningful and participatory learning, is central to the vision of sustainability and social justice. AI technologies, with their capacity for adaptation, automation, and personalization, appear to align well with this vision. However, their implementation in educational contexts raises critical questions about equity, access, ethics, and effectiveness—particularly for marginalized and underrepresented learners.

This study investigates the perceived role of AI in supporting inclusive education, with particular focus on how various stakeholders interpret and engage with AI-driven tools and systems. By exploring these perceptions, the study seeks to contribute to the discourse on how technological innovation can be harnessed responsibly to support inclusive and sustainable educational futures.

The Concept of Inclusive Education

Inclusive education refers to an educational approach that recognizes and responds to the diverse needs of all learners by removing barriers to participation and learning. It is rooted in the principles of equity, justice, and the right to education (UNESCO, 2017). As part of the global commitment to SDG 4, inclusive education is seen as a critical means of ensuring that no learner is left behind in the pursuit of quality education. Mag, Sinfield and Burns (2017) resolutely suggested that inclusion should try at all costs to incorporate children of various ethnicities and cultural backgrounds. Therefore, an inclusive environment should be nurturing and, above all, safeguard children from harm and strive to educate all. Educators must do their best to ensure students receive adequate education. Hence, the curriculum should be revised to cater to the needs of all students. Mag, Sinfield, and Burns (2017) also affirmed that suitable opportunities must be afforded so that all students are free to optimize their aptitude.

The Universal Design for Learning (UDL) framework supports inclusive education by advocating for flexible learning environments that accommodate individual differences (CAST, 2018). However, the implementation of inclusive education remains challenging due to systemic inequities, lack of resources, and insufficient teacher training.

Artificial Intelligence in Education

AI in education encompasses tools such as intelligent tutoring systems, learning analytics, speech and image recognition, and personalized learning algorithms. These tools are designed to enhance learning outcomes by adapting content delivery, automating feedback, and improving administrative efficiency (Luckin et al., 2016; Holmes et al., 2019). Artificial intelligence is increasingly being shaped to enhance authentic educational experiences by tackling long-standing complex challenges—often referred to as "wicked problems"—such as fostering student engagement and inclusion, delivering personalized learning content, and providing adaptive feedback throughout the learning journey (Holmes et al., 2022). Additionally, AI holds promise in supporting educators by automating routine tasks like grading, responding to frequently asked questions, and managing attendance. This, in turn, can free up valuable time for teachers to focus on personalized student support and meaningful interactions (Kim, 2024). Despite their promise, the use of AI in education has raised important concerns. Questions surrounding data privacy, algorithmic bias, and ethical deployment remain unresolved, particularly in under-resourced or inequitable educational contexts (Williamson & Eynon, 2020).

AI and Inclusion: Opportunities and Challenges

AI offers significant opportunities to enhance inclusion by providing personalized learning paths, supporting students with disabilities, and offering multilingual learning environments. However,

the risk of exclusion remains if these tools are not developed or implemented equitably (Zawacki-Richter et al., 2019; Selwyn, 2020). The widespread adoption of artificial intelligence (AI) in education is regarded as one of the most consequential developments of the 21st century (Becker et al., 2018; Seldon & Abidoye, 2018). AI is increasingly recognized as a robust tool for enhancing teaching and learning processes across diverse educational contexts. According to Holmes et al. (2023) and Hwang et al. (2020), AI also contributes significantly to instructional design, technological innovation, and the advancement of educational research. Its integration into educational settings has been shown to transform pedagogical practices by enabling personalized learning experiences and providing timely, adaptive feedback, thereby fostering more inclusive and effective learning environments. Nevertheless, achieving truly inclusive education remains a complex endeavor. The incorporation of all learners within mainstream educational systems necessitates deliberate attention and, in many cases, substantial modifications to curriculum design. These adjustments may span a range of domains, including technological infrastructure, organizational strategies, pedagogical approaches, ethical frameworks, and psychological support mechanisms.

Yang (2022) emphasized the value of AI in education, highlighting its ability to integrate diverse disciplinary knowledge and multiple technologies simultaneously. In agreement, Nemorin et al. (2023) argued that AI has become an essential element in modern educational systems. Supporting this view, Kamalov et al. (2023) and Ouyang and Jiao (2021) noted the rapid acceleration of AI integration in educational contexts. Alongside these technological advancements, Salas-Pilco and Oshima (2022) proposed that inclusive education is equally critical, as it promotes equity and quality for all learners, fosters intelligence, and contributes to a more just society. Similarly, Hardy and Woodcock (2023) underscored that inclusive education is foundational to creating equitable learning environments, reinforcing principles of diversity, equality, and social justice.

Chauhan (2017) emphasized the significant potential of AI technologies in both societal and educational contexts, suggesting that their introduction could profoundly reshape education and contribute meaningfully to students' overall well-being. Salas-Pilco (2020) further noted that AI fosters innovation and enhances both teaching and learning processes. Similarly, Grimus (2020) highlighted the capacity of these emerging technologies to support students' multisensory engagement by creating inclusive environments that affirm and accommodate diverse learning needs (Hite et al., 2020). McMahon et al. (2020) also stressed the importance of authentic learning environments in promoting collaboration and reinforcing positive social behaviors. Collins (2018) and Shore et al. (2018) asserted that inclusive education is fundamentally aimed at ensuring equal opportunities for all learners. In alignment with this perspective, Halverson (2018) proposed that educational technologies can facilitate more equitable access to learning and promote inclusion. However, Bransford et al. (2000) cautioned that the benefits of technological integration are not inherently guaranteed; rather, their effectiveness depends on thoughtful implementation within teaching and learning contexts. As Petko et al. (2018) argued, successful integration is influenced by multiple factors, including the willingness of students and educators to adopt digital tools, the cultural relevance of technological design, and a deep understanding of learners' diverse backgrounds. Additionally, Xu and Ouyang (2021) and Ouyang et al. (2022) confirmed that AI applications now span nearly all domains within education.

Artificial intelligence can serve as a powerful tool for promoting awareness around issues related to diversity, equity, and inclusion. AI-driven technologies—such as chatbots, virtual assistants, and educational platforms—can disseminate relevant information, offer training on topics like unconscious bias and cultural competence, and support the adoption of inclusive practices.

According to Becker et al. (2018) and Seldon and Abidoye (2018), a broad understanding of available AI tools enables educators to more effectively recognize and address the diverse learning needs of their students. To foster equitable and accessible learning environments, it is essential that educators remain informed about these technologies and understand how to implement them in pedagogically meaningful ways.

Successful implementation requires not only technical capability but also cultural relevance, teacher preparedness, and inclusive policy frameworks. As such, understanding stakeholder perceptions of AI's role is crucial for its sustainable and equitable adoption.

Purpose of the Study

The study seeks to

1. investigate the disposition of teachers towards in achieving sustainable development goals through inclusive education;
2. examine the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development;
3. ascertain the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development;
4. find the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on gender; and
5. find the relationship in the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on Education Attainment

Research Questions

1. What is the disposition of teachers towards in achieving sustainable development goals through inclusive education
2. What are the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development
3. What is perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development

Hypotheses

HO₁: There is no significant difference in the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on gender

HO₂: There is no significant relationship in the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on Education Attainment.

Methodology

Descriptive survey Research Design was used for the study. The population for the study encompasses all secondary school teachers in Oyo State. Simple random sampling technique was used to select 200 teachers across 4 local government areas of Oyo state (Atiba, Oyo East, Afijio and Oyo West). A self-designed instruments for the data collection were; disposition of teachers towards achieving sustainable development goals through inclusive education questionnaire (DTASDGIEDQ) and perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development (PTRAISIESDQ). The instruments were divided into two sections each, while section A reveals the demographic characteristics of the respondents, Section B of DTASDGIEDQ contains 10 statements which measures disposition of

teachers towards achieving sustainable development goals through inclusive education while PTRAIIESDQ measure perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development. The two instruments were rated on 4-point Likert scale of SA, A, D and SD. The instruments for the data collection for the study were; disposition of teachers towards achieving sustainable development goals through inclusive education questionnaire (DTASDGIEDQ) and perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development (PTRAIIESDQ). The validation process was ascertained by experts in educational technology, special education and test and measurement, while the reliability of the instruments was ascertained using Cronbach alpha reliability technique and indexes of 0.78 and 0.85 were calculated for DTASDGIEDQ and PTRAIIESDQ, respectively. The study adopted descriptive statistics (mean, standard deviation, frequency count and simple percentage) to answer the research questions and Inferential statistics (T-test and Analysis of variance) to test the hypotheses.

Results

Research Question One: What is the disposition of teachers towards achieving sustainable development goals through inclusive education?

Table 1: Disposition of teachers towards achieving sustainable development goals through inclusive education

S/N	Items	SA	A	D	SD	Mean	SD
1	Teachers should be optimistic that their efforts as a teacher in promoting inclusive education can make a tangible contribution to a more sustainable future for all	120 (60)	60 (30)	10 (10)	10 (10)	3.14	0.53
2	effectively teach about sustainable development in an inclusive manner feel should be supported with the necessary resources	145 (70)	40 (20)	15 (7.5)	-	3.31	0.44
3	The principles of inclusive education, such as providing equitable opportunities, are directly aligned with achieving social and economic sustainability	46 (23)	154 (77)	-	-	2.68	0.91
4	Teachers should be willing to actively seek out professional development opportunities to better link inclusive teaching practices with the objectives of the Sustainable Development Goals	130 (65)	58 (29)	12 (6)	-	3.34	0.46
5	Teachers commitment to inclusive education helps students develop the empathy and respect for diversity necessary for building peaceful and sustainable communities	100 (50)	60 (30)	30 (15)	10 (5)	2.90	0.84
6	ensuring no child is left behind in my classroom directly contributes to the broader SDG principle of 'leaving no one behind' in society	88 (44)	60 (30)	40 (20)	12 (6)	2.80	0.91
7	Teachers should be confident in their ability to adapt teaching methods to ensure that students with diverse abilities can engage meaningfully with topics related to sustainable development	172 (86)	28 (14)	-	-	3.72	0.45

8	Creating an inclusive learning environment is a key strategy for fostering the values of global citizenship and social equity outlined in the SDGs	162 (81)	28 (14)	10 (5)	-	3.62	0.49
9	I feel a personal sense of responsibility to integrate themes of sustainable development (e.g., poverty reduction, gender equality, climate action) into my teaching in a way that is accessible to all learners	146 (73)	54 (27)	-	-	3.48	0.54
10	I believe that practicing inclusive education in my classroom is fundamental to achieving the global Sustainable Development Goals	74 (37)	26 (13)	50 (25)	50 (25)	3.76	0.48

Weighted Average Mean = 3.3 (82.5) Positive

The table above revealed that the disposition of teachers towards achieving sustainable development goals through inclusive education is Positive (Weighted Average = 3.3). The overall Weighted Average Mean of 3.3 (82.5% Positive) indicates a generally positive disposition of teachers towards achieving Sustainable Development Goals (SDGs) through inclusive education.

- Strong Agreement on Fundamental Link: Item 1, "Teachers should be optimistic that their efforts as a teacher in promoting inclusive education can make a tangible contribution to a more sustainable future for all," shows high agreement with a mean of 3.14. Similarly, Item 10, "I believe that practicing inclusive education in my classroom is fundamental to achieving the global Sustainable Development Goals," has a high mean of 3.76, suggesting teachers strongly perceive a direct and crucial link between inclusive education and achieving SDGs.
- Confidence in Adapting Teaching: Item 7, "Teachers should be confident in their ability to adapt teaching methods to ensure that students with diverse abilities can engage meaningfully with topics related to sustainable development," has the highest mean of 3.72. This indicates a very strong disposition among teachers regarding their capacity to make SDG-related content accessible to all students.
- Emphasis on Equitable Opportunities and Global Citizenship: Item 3, "The principles of inclusive education, such as providing equitable opportunities, are directly aligned with achieving social and economic sustainability," has a mean of 2.68. Item 8, "Creating an inclusive learning environment is a key strategy for fostering the values of global citizenship and social equity outlined in the SDGs," shows high agreement with a mean of 3.62. These highlight the teachers' recognition of inclusive education as a vehicle for promoting broader SDG principles of fairness and global awareness.
- Personal Responsibility and Professional Development: Item 9, "I feel a personal sense of responsibility to integrate themes of sustainable development into my teaching in a way that is accessible to all learners," has a strong mean of 3.48. Item 4, "Teachers should be willing to actively seek out professional development opportunities to better link inclusive teaching practices with the objectives of the Sustainable Development Goals," also shows high agreement with a mean of 3.34. This suggests teachers feel personally accountable and are willing to enhance their skills to integrate SDGs inclusively.
- Contribution to Peaceful Communities: Item 5, "Teachers commitment to inclusive education helps students develop the empathy and respect for diversity necessary for building peaceful and sustainable communities," has a mean of 2.90, indicating agreement that inclusive practices foster key social aspects of sustainability.
- Support for Resources: Item 2, "effectively teach about sustainable development in an inclusive manner feel should be supported with the necessary resources," has a high mean

of 3.31, suggesting teachers acknowledge the need for adequate resources to effectively teach about sustainable development inclusively.

In summary, teachers generally hold a strong and positive disposition towards their role in achieving sustainable development goals through inclusive education, particularly emphasizing their confidence in adapting teaching, the foundational link between inclusive education and SDGs, and a sense of personal responsibility.

Research Question 2: What is perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development?

Table 2: Perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development.

S/N	Items	SA	A	D	SD	Mean	SD
1	AI-powered tools can effectively assist teachers in adapting learning materials for students with diverse learning needs and disabilities in the classroom	108 (54)	64 (32)	16 (8)	12 (6)	3.33	0.79
2	The integration of AI in education can improve equitable access to quality learning opportunities for all my students, especially those in disadvantaged situations	144 (72)	30 (15)	20 (10)	6 (3)	2.19	1.39
3	AI-driven data analytics could provide me with valuable insights to better understand and address individual student learning gaps, fostering a more inclusive classroom	92 (46)	90 (45)	18 (9)	-	2.47	0.65
4	using AI in teaching can help prepare students with the necessary digital literacy skills for a future focused on sustainable development	146 (73)	44 (22)	10 (5)	-	3.38	0.65
5	AI technologies, such as speech-to-text or personalized visual aids, significantly enhance the participation of my students with sensory impairments in classroom activities	134 (67)	52 (26)	14 (7)	-	3.14	0.80
6	the implementation of AI in education would reduce my administrative workload, allowing me more time to provide individualized support to students who need it most	127 (63.5)	39 (19.5)	22 (11)	12 (6)	3.00	1.13
7	AI-based assessment tools can offer more objective and personalized feedback to my students, accommodating their varied learning progressions	119 (59.5)	63 (31.5)	18 (9)	-	3.03	1.14
8	AI tools designed for inclusive education are developed with ethical considerations to ensure they genuinely benefit all students without creating new forms of exclusion	154 (77)	42 (21)	4 (2)	-	3.33	0.79
9	AI can effectively facilitate the creation of personalized learning pathways for my students, allowing them to learn at their own pace and accommodate differences in their cognitive abilities	100 (50)	70 (35)	17 (8.5)	13 (6.5)	2.87	0.79
10	Investing in AI for inclusive education is a sustainable and beneficial approach for the overall educational system and future societal development	116 (58)	65 (32.5)	19 (9.5)	-	3.17	0.65
Weighted Average Mean = 3.0 (75%) Positive							

The above revealed that the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development is Positive (Weighted Average = 3.0). The overall Weighted Average Mean of 3.0 (75% Positive) indicates a generally positive perception among teachers regarding the role of AI in supporting inclusive education for sustainable development.

- **Positive View on AI for Adaptation and Ethical Development:** Item 1, "AI-powered tools can effectively assist teachers in adapting learning materials for students with diverse learning needs and disabilities in the classroom," has a mean of 3.33, showing strong agreement. Similarly, Item 8, "AI tools designed for inclusive education are developed with ethical considerations to ensure they genuinely benefit all students without creating new forms of exclusion," also has a mean of 3.33, indicating that teachers perceive AI tools as beneficial for adaptation and believe they are ethically developed.
- **AI for Digital Literacy and Sustainability:** Item 4, "using AI in teaching can help prepare students with the necessary digital literacy skills for a future focused on sustainable development," has a high mean of 3.38, suggesting teachers see AI as vital for equipping students with future-ready skills relevant to sustainable development.
- **Enhancing Participation and Personalization:** Item 5, "AI technologies, such as speech-to-text or personalized visual aids, significantly enhance the participation of my students with sensory impairments in classroom activities," shows a mean of 3.14. Item 9, "AI can effectively facilitate the creation of personalized learning pathways for my students, allowing them to learn at their own pace and accommodate differences in their cognitive abilities," has a mean of 2.87. These indicate teachers' belief in AI's ability to boost student engagement and offer tailored learning experiences, especially for students with sensory impairments.
- **Support for Administrative Workload and Feedback:** Item 6, "the implementation of AI in education would reduce my administrative workload, allowing me more time to provide individualized support to students who need it most," has a mean of 3.00. Item 7, "AI-based assessment tools can offer more objective and personalized feedback to my students, accommodating their varied learning progressions," has a mean of 3.03. This suggests teachers see AI as a potential aid in reducing administrative tasks and providing better feedback.
- **Equitable Access - Mixed Perception:** Item 2, "The integration of AI in education can improve equitable access to quality learning opportunities for all my students, especially those in disadvantaged situations," has a lower mean of 2.19 compared to other items, with a higher standard deviation of 1.39. This indicates a more mixed or less consistently positive perception regarding AI's direct impact on improving equitable access for disadvantaged students.
- **AI for Learning Gaps and Overall Investment:** Item 3, "AI-driven data analytics could provide me with valuable insights to better understand and address individual student learning gaps, fostering a more inclusive classroom," has a mean of 2.47. Item 10, "Investing in AI for inclusive education is a sustainable and beneficial approach for the overall educational system and future societal development," has a mean of 3.17. This suggests that while teachers see the potential of AI for data analysis to address learning gaps, there's a strong overall belief in the sustainability and benefit of investing in AI for inclusive education.

Overall, while teachers hold a generally positive perception of AI's role in supporting inclusive education for sustainable development, particularly in areas of content adaptation, digital literacy, and administrative support, there is a slightly less uniform agreement on its direct impact on equitable access for disadvantaged students and in providing insights from data analytics.

Hypotheses

HO₁: There is no significant difference in the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on gender

Table 3: Summary of T-test showing the difference in the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on gender

Variables	N	Mean	Standard Deviation	Df	T	Sig.	Remark
Male	80	10.75	3.77	198	0.32	0.97	Not Significant
Female	120	11.92	2.67				

The table above shows that there is no significant difference in the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on gender ($t = 0.32$; $df = 198$; $p > 0.05$). Therefore, hypothesis 1 is not rejected.

HO₂: There is no significant relationship in the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on Education Attainment

Table 4: Summary of ANOVA showing the Relationship in the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on Education Attainment

Variables	N	Mean	Standard Deviation	Df	F	Sig.	Remark
N.C.E	49	22.10	2.90	3,197	0.45	0.07	Not Significance
B.Ed/B.A/BSc/Equivalent	114	23.07	2.30				
Postgraduate	37	21.00	3.08				
Total	200	21.93	3.47				

The table shows that there is no significant relationship in the perception of teachers on the role of Artificial Intelligence in Supporting Inclusive Education for Sustainable Development based on Education Attainment ($F_{(3, 197)} = 0.45$; $P > 0.05$). Therefore, hypothesis 2 will not be rejected.

Discussion of Findings

The data presented in Table 1 unequivocally indicates a "positive" disposition among teachers regarding their role in achieving SDGs through inclusive education, evidenced by a Weighted Average Mean of 3.3 (82.5% Positive). This finding is significant, as it underscores a fundamental alignment between pedagogical practice and global sustainability objectives. Teachers demonstrate a strong belief that their efforts in promoting inclusive education directly contribute to a more sustainable future for all (mean of 3.14). This perception is further solidified by the high mean of 3.76 for the item stating that practicing inclusive education is fundamental to achieving global SDGs (United Nations, 2015). A key strength identified is the high confidence among teachers in their ability to adapt teaching methods to ensure students with diverse abilities can meaningfully engage with sustainable development topics (mean of 3.72). This adaptive capacity

is crucial for genuine inclusion and aligns with the principles of Universal Design for Learning (CAST, 2018), which advocates for flexible learning environments. Furthermore, teachers recognize that creating an inclusive learning environment is a key strategy for fostering global citizenship and social equity as outlined in the SDGs (mean of 3.62). This perspective is strongly supported by Hardy and Woodcock (2023), who underscore that inclusive education is foundational to creating equitable learning environments and reinforces principles of diversity, equality, and social justice.

The study also reveals a strong sense of personal responsibility among teachers to integrate sustainable development themes accessibly into their teaching (mean of 3.48). This proactive stance is complemented by a willingness to actively seek professional development opportunities to better link inclusive teaching practices with SDG objectives (mean of 3.34). Such commitment is vital for continuous improvement and effective integration of complex global goals into classroom realities. The acknowledgment by teachers that support with necessary resources is crucial for effectively teaching about sustainable development in an inclusive manner (mean of 3.31) also points to a practical understanding of the systemic needs required to translate their positive disposition into effective action. This highlights that while teachers are willing, they also recognize the need for adequate institutional support.

Result on table illustrates a generally "Positive" perception among teachers regarding the role of AI in supporting inclusive education for sustainable development, with an overall Weighted Average Mean of 3.0 (75% Positive). This optimism aligns with the view that AI presents novel opportunities to enhance teaching, personalize learning, and increase accessibility for diverse learners.

Teachers show strong agreement that AI-powered tools can effectively assist in adapting learning materials for students with diverse learning needs and disabilities (mean of 3.33). This perception is bolstered by the belief that AI tools for inclusive education are developed with ethical considerations to genuinely benefit all students without creating new forms of exclusion (mean of 3.33). This dual emphasis on adaptation and ethical development is critical for responsible AI integration in education. The capacity of AI technologies for adaptation, automation, and personalization appears to align well with the vision of inclusive education. Salas-Pilco (2020) further noted that AI fosters innovation and enhances both teaching and learning processes, while Grimus (2020) highlighted the capacity of these emerging technologies to support students' multisensory engagement by creating inclusive environments that affirm and accommodate diverse learning needs (Hite et al., 2020).

A high mean of 3.38 for the item on using AI to help prepare students with necessary digital literacy skills for a future focused on sustainable development signifies teachers' recognition of AI as a vital tool for equipping students with future-ready competencies. This aligns with the idea that AI can transform pedagogical practices by enabling personalized learning experiences and providing timely, adaptive feedback, thereby fostering more inclusive and effective learning environments. Chauhan (2017) emphasized the significant potential of AI technologies in both societal and educational contexts, suggesting their introduction could profoundly reshape education and contribute meaningfully to students' overall well-being. Teachers also perceive AI as enhancing participation for students with sensory impairments through technologies like speech-to-text or personalized visual aids (mean of 3.14). They also see AI facilitating personalized learning pathways, allowing students to learn at their own pace and accommodate cognitive differences (mean of 2.87). This indicates a belief in AI's ability to boost student engagement and offer tailored learning experiences, directly addressing the "wicked problems" of

fostering student engagement and inclusion, and delivering personalized learning content (Holmes et al., 2022).

The perceived benefits of AI extend to reducing administrative workload (mean of 3.00) and offering more objective and personalized feedback (mean of 3.03). This suggests that teachers see AI as a valuable aid in streamlining routine tasks, thereby freeing up valuable time for more individualized student support and meaningful interactions (Kim, 2024). However, a notable finding is the "mixed or less consistently positive perception" regarding AI's direct impact on improving equitable access to quality learning opportunities for disadvantaged students (mean of 2.19, with a high standard deviation of 1.39). This lower agreement points to a critical area of concern, as the risk of exclusion remains if AI tools are not developed or implemented equitably (Zawacki-Richter et al., 2019; Selwyn, 2020). This highlights persistent questions surrounding data privacy, algorithmic bias, and ethical deployment, particularly in under-resourced or inequitable educational contexts (Williamson & Eynon, 2020). Despite this reservation, there is a strong overall belief in the sustainability and beneficial nature of investing in AI for inclusive education for the overall educational system and future societal development (mean of 3.17). This overarching positive view reinforces the widespread adoption of AI in education as one of the most consequential developments of the 21st century (Becker et al., 2018; Seldon & Abidoye, 2018).

Conclusion

The study reveals a strong and generally positive disposition among teachers in Oyo State towards achieving Sustainable Development Goals (SDGs) through inclusive education. Teachers overwhelmingly believe in the direct link between inclusive practices and a sustainable future, demonstrating confidence in their ability to adapt teaching methods for diverse learners and a personal responsibility to integrate SDG themes into their curricula. Furthermore, teachers hold a largely positive perception of Artificial Intelligence (AI) as a supportive tool for inclusive education and sustainable development. They recognize AI's potential in adapting learning materials, fostering digital literacy, enhancing participation for students with sensory impairments, and streamlining administrative tasks. This aligns with the understanding that AI can personalize learning experiences and improve overall educational effectiveness. However, a notable concern exists regarding AI's direct impact on improving equitable access for disadvantaged students, indicating a "mixed or less consistently positive perception" in this area. This highlights the ongoing challenges of ensuring equitable development and implementation of AI tools, particularly in contexts with limited resources or existing inequities. Despite this, there's a strong overarching belief in the long-term benefits and sustainability of investing in AI for inclusive education.

Recommendations

Based on these findings, the following recommendations are made:

- Provide adequate resources and support for teachers: While teachers show a strong positive disposition, they acknowledge the need for necessary resources to effectively integrate inclusive education and sustainable development goals. Educational authorities should prioritize providing funding, materials, and technological infrastructure.
- Invest in professional development focused on AI for inclusive education: Given teachers' willingness to seek professional development, training programs should be developed to enhance their skills in utilizing AI tools for adapting learning materials, creating personalized pathways, and addressing diverse learning needs ethically

- Address equitable access and algorithmic bias in AI development and implementation: The mixed perception regarding AI's impact on equitable access for disadvantaged students is a critical area
- Policymakers and AI developers must prioritize the creation of AI tools that are accessible, affordable, culturally relevant, and designed to genuinely benefit all learners, actively mitigating algorithmic bias and privacy concerns.
- Foster collaboration between educators, AI developers, and researchers: To ensure AI tools truly meet the needs of inclusive education, ongoing dialogue and collaboration are essential. This can help bridge the gap between technological capabilities and pedagogical realities, ensuring effective and ethical deployment.

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RELATIONSHIP BETWEEN TERTIARY INSTITUTIONS STUDENTS' EXPECTATIONS OF EMPLOYMENT IN THE WORLD MARKET AND SUSTAINABILITY SKILLS AFTER GRADUATION

Johnson Tunde Ajiboye (Ph.D)

Department of Educational Management Library and Information Science

Emmanuel Alayande University of Education, Oyo

ajiboyejohnsontunde@gmail.com

Abstract

This study examines the employment expectations of students in Oyo State tertiary institutions in relation to sustainability skills after graduation in Oyo State tertiary institutions. The study adopted survey design of correlational type. The sample consisted of 90 tertiary institution graduates who were selected using mixed sampling techniques of convenience/accidental and snowball across Oyo State. Instruments used were: Expectations of Employment Scale (EES; $r=0.79$) and Job Sustainability Skills Scale (JSSS; $r=0.91$). Data were analysed using Pearson product moment correlation and multiple regression at 0.05 level of significance. Career Preparedness ($r=0.62$), Global Employment Awareness ($r=0.86$), Job Market Confidence ($r=0.76$) and Industry Connection and Networking ($r=0.96$) had significant relationship with sustainability skills after graduation. There was a significant joint correlation of expectations of employment ($R=0.96$) on sustainability skills after graduation with contribution of 91.8% to the total variance of sustainability skills after graduation. Global Employment Awareness, Job Market Confidence and Industry Connection and Networking had equal ($\beta=0.95$, $t=24.07$) significant relative contributions to sustainability skills after graduation. Global Employment Awareness, Job Market Confidence and Industry Connection and Networking influenced sustainability skills after graduation. Tertiary institution graduates should possess good knowledge of global employment awareness, job market confidence and industry connection and networking in order to have a better control over job sustainability skills.

Keywords: Student Expectations, Employment, World Market, Sustainability Skills, Oyo State.

Introduction

Sustainability, the ability to maintain or support a process over time, involves meeting the needs of the present without compromising the ability of future generations to meet their own needs. (Black 2021) Sustainable Skills connect governments, industry, international development aid agencies, education providers and communities to build effective Technical and Vocational Educational Training (TVET) and education systems, skilled work forces and participants who grow as they learn. Sustainable development is aptly defined as growth which focuses on using pattern of resource to meet human needs while preserving the surroundings so that the necessities of citizens can be met in the present time without compromising the ability of future generations to meet their own needs (United Nations, 2004). Sustainability is often broken into three core concepts: economic, environmental and social sustainability seeks to prevent the depletion of natural or physical resources, so that they will remain available for the long term. Ban ki-moon, a former United Nation Secretary General (2012) avers that the Higher Education Sustainability initiative aims to get institutions of higher education to commit to teach sustainable development concepts, encourage research on sustainability efforts in their communities.

Successive Nigerian governments have introduced and are still introducing several plans aimed at serving as a pillar for expanding the country's possibility frontiers. A few of these plans are Youth

Empowerment scheme, Rural Infrastructure Development Scheme, and National Economic Empowerment and Development Strategy (NEEDS) (Ikhide & Alawode, 2010). Institutions of higher learning all over the world are responsible for educating, analyzing data, creating information and imparting knowledge, which is of utmost importance for development of the future for sustainability in different societies (Alufohai, 2012). In the study conducted by Otoh (2012), it was emphasized that higher education is a correlate of socio-economic development and most especially an important procedure in economic growth all over the planet in an attempt to improve productivity, empowerment and social welfarism of citizens. International internships provide students with exposure to the challenges and opportunities in today's global market place. International internships may foster the development of global competencies and provide returning interns with a competitive advantage in the labour market. International career experiences will be invaluable for competing in today's global marketplace where career success and advancement is likely to be dependent on having international experience and knowledge (Krell, 2010). Universities need to provide their students with opportunities to participate in international, as well as domestic, service learning projects. Students report that these types of volunteer and service learning opportunities provide them with exposure to real world problems and the nonprofit agencies that are working to solve these problems (O'Neill, 2010).

Nigeria has a serious problem of increasing rate of jobless young population, where being highly educated does not guarantee the chance of finding a job. For those who are lucky to find jobs, employers are concerned about their skills that are fitting for their job requirements. The National Population Commission (NPC, 2013) states that about half of the Nigerian population is made up of youth whose ages range from 15-34 years. The dark side of it is that as the youth population grows so does the unemployment rate. At present policy makers are confronted with inadequate information and data that can form the basis of planning (Asaju et.al, 2014; Iwayemi, 2013). Worse is employment data are very hard to obtain, even from statutory institutions and agencies established for gathering socio-economic data. It is even more worrisome that where the register of employment exists, not all those searching for employment attempt to register. Butterfield (2010) in his study conducted on TVET was of the opinion that the primary objective of TVET is to prepare students in a manner that enables them acquire the necessary skills for paid or self-employment in a specific occupation and so has been acclaimed the best to provide employment to youths worldwide especially the Nigerian Youths. Employers expect graduates to be equipped with requisite life skills such as problem solving, reflective and critical thinking, self-discipline, organizing skills and abilities to translate ideas into action. The problem typical of higher education in many countries is that these life skills are rarely taught as part of higher education curriculum (Akanmu, 2011). Industries such as energy, manufacturing, construction, ICT, meat and poultry, oil palm and cocoa along with their value chains have very high employment potential. They are to be the focus of Nigeria's industrial policy to ensure that its economic growth numbers have real meaning in jobs and life opportunities for Nigeria youths and higher education graduates (Akanmu, 2011).

Future thinking is also known as anticipatory thinking, foresight, or transgenerational thinking. Sustainability requires future thinking. It includes "the ability to collectively and analyze, evaluate, and craft rich "pictures" of the future related to sustainability issues and sustainability problem-solving frameworks (Wiek et.al, 2011). In study conducted by (Gibson, 2006), it is established that there is need to anticipate and imagine how today's solutions could introduce negative cascading effects and become tomorrow's problems. In this same vein, we have to work through plausible scenarios of the future that can lead to safer, happier, and healthier futures. Values thinking is also known as value-focused thinking, orientation thinking/knowledge and or ethical thinking. Sustainability is a field that is problem-oriented and solution driven, potential

solutions require values thinking i.e to apply, reconcile, collectively map and negotiate (Wiek et.al, 2011).

Strategic thinking is also required in sustainability. It means finding creative ways to solve the critical problems of our time and understanding and working to reduce inequalities. One common stumbling block to strategic thinking is the status quo (Wheeler, 2014). System thinking is another factor which is of utmost important for sustainability to be deeply rooted. It is the ability to collectively analyze complex systems across different domains (society, environment, and economy). System thinking requires that we capture, begin to understand and recognize that a system is a configuration of parts connected and joined together by a web of relationships, flows, and / or network (Wiek et.al, 2011).

Graduation from ivory-towers on completion of tertiary education is a major career-transition. (Inkdon et.al, 2012) Thus, graduating without specific skills, knowledge of the labour market and proactive career behaviors are a major itch that should be discussed alongside (Somerville & Scholarios, 2014) to secure sections of the labour market for which graduates are qualified, together with their future career self-management. The expectations of the would-be graduates while in training in their various institutions is that they perceived the degree certificates as the most recent evidence of academic ability, achievement and prosperous living life. In the global market today, students no longer see the degree itself as sufficient (Stevenson & Clegg, 2011). In the past decades, approaches to graduate employability development was solely based on the curriculum of various disciplines as well as generic skills for work (human capital approach) (Holmes, 2013). In this 21st century, employability is more than work skills and is highly linked to students' identity and sense of self, and perseverance in their career across their lifespan (Jackson, 2016).

From the labour market perception, students when they get to the penultimate or final year of study perceive themselves to be less employable, reasons attributed to the challenges posed by the global labour market (a) volume of graduates (b) lack of jobs available and (c) receiving rejections for job applications (Jackson & Witton, 2017; Quenani et al., 2014). On the other hand, students personally see their personal development as invaluable during their years of study in the university as license to good work after graduation for example, university degree, university tone, clubs/societies, work experience, so therefore perceive themselves to be more employable in the labour market but in the actual fact, less employable (Remedios, 2012). Holmes (2013) posit that a graduate can be employable without necessarily being employed.

Organizations recruit individuals possessing the highest knowledge and skill levels for each position, students must make themselves more employable by cultivating the qualified organizations need. Such qualities go beyond the academic to include experience, knowledge, creativity, innovation and skills that the labour market demands and universities play a critical role in their development (EHEA, 2020). According to a research conducted by OECD countries, the number of employed graduates is not at a desired level and the number of unemployed is increasing, despite the recent rise in the number of students attending higher education in some countries (Alvarez-Gonzalez et al., 2017). It is often mentioned that the education received by college graduates is insufficient to meet job-related qualifications (Carroll & Tani, 2013). The concept of employability which denotes the qualification to be hired in the various labour market has become a critical consideration for university students (Wittekind et al., 2010). Of a truth, focusing on employability does not guarantee that students will find the jobs they seek (McQuaid & Lindsay, 2005; Varheast & Vander, 2013), it does give them the opportunity to acquire the skills that prospective employers demand (Rothwell et.al, 2009).

Employability also depends on environmental factors (Berntson et al., 2006). This includes macroeconomic factor such as labour market (Chou & Shen, 2012) and economic conditions (Qenani et al., 2014) as well as the university brand, the university academic program, the work experience provided by the university, (Cabarello et.al, 2015) and the impact of the teaching staff or consultant (Alvarez-Gonzalez et al., 2017).

Theoretical Framework: Equity Theory

Equity theory, a theory of motivation, concentrates on people's perceptions of the fairness of their work outcomes relative to, or in proportion to their work inputs. The theory was formulated in the 1960s by J. Stacy Adams, who stressed that what is important in determining motivation is the relative rather than absolute levels of outcomes a person receives and inputs a person contributes. Equity theory complements expectancy and need theories by focusing on how people perceive the relationship between the outcomes they receive from their jobs and organizations and inputs they contribute. Specifically, motivation is influenced by the comparison of one's own outcome input ratio with the outcome-input ratio of a referent. The referent could be another person or a group of people who are perceived to be similar to oneself, the referent also could be oneself in a previous job or one's expectations about what outcome input ratios should be.

Various studies have established strong link and relationship between tertiary student expectations of employment in the world market and sustainability skills after graduation, however, most of these studies were carried out outside Nigeria and the few that were conducted in Nigeria were in other areas than tertiary education and the extent at which these expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) would jointly and relatively predict sustainability skills after graduation were not examined. This study is therefore set to examine the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) that would be effective in predicting sustainability skills after graduation in Oyo State tertiary institutions.

Statement of the Problem

After few years of independence in Nigeria, graduates of few tertiary institutions that had been established then were gainfully employed. Graduates of tertiary institutions were very few. As years rolled by, up till late 1970s Nigeria enjoyed the oil boom and civil servant were catered for by the successive governments. National youth service corps programme was introduced in 1978 which stands as a unifying factor for all Nigerians. University graduates, graduates of polytechnics (HND) and Graduates of Colleges of Education (NCE) were those that participated in the one-year national service programme. Economic recession infiltrated in 1985 when graduates from colleges of education were no longer allowed to participate in the said programme. Several homegrown initiatives/programme were introduced to cushion the effect of oil doom such as Structural Adjustment Programme (SAP) Operation Feed the Nation (OFN) National Directorate of Employment (NDE) to mention but few. The quest for tertiary education by majority of the populace in Nigeria led to establishment of many more universities/polytechnics and colleges of education that were poorly funded by state government, federal government as well as private institutions. The problems become exacerbated when graduates of tertiary institutions graduated without sustainable skills during training in their institutions. Parents, guardians, stakeholders had to start giving stipends to their children/ward with them at home having spent some number of years in the school. Some of the graduates that could not endure economic hardship had resulted to various forms of vices such as pilfering, theft, rape, thugs during electioneering campaign hence, the expectations of would-be graduates while in training was that after graduation, they would be gainfully employed, but vis-à-vis-economic problem,

population explosion, politics, the desire of majority of the graduates are just like illusion. The need for this study at this 21st century is of immense important in the global market. This study is therefore set to examine the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) that would be effective in predicting sustainability skills after graduation in Oyo State tertiary institutions.

Research Questions:

1. What is the relationship between the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) and sustainability skills after graduation?
2. What is the joint contribution of the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) on sustainability skills after graduation?
3. What is the relative contribution of the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) on sustainability skills after graduation?
4. Which of the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) predicts sustainability skills after graduation most?

Scope of the study

This study examined expectations of employment and sustainability skills after graduation in Oyo state tertiary institutions. The study covered the tertiary institutions in the three senatorial zones of Oyo State, with both private and public owned institutions in each zone.

Research Design

The study adopted survey of correlational type. This study investigated and reported the existing situations and conditions in view of the variables in the study.

Population of the Study

The study population composed of all tertiary institution graduates in both private and public owned institutions in Oyo State.

Sample and Sampling Procedure

Mixed method of sample selection was used and Ninety graduates in both private and public owned institutions in Oyo State were selected using convenient/accidental sampling technique and snowball sampling technique.

Research Instruments

Two research instruments were employed in this study. These are:

1. Expectations of Employment Scale (EES).
2. Job Sustainability Skills Scale (JSSS).

Expectations of Employment Scale (EES)

This is a 60-item researcher's self-developed instrument. It consists of statements concerning the expectations of employment by tertiary institution graduates. It consists of two sections, A and B. Section A consists of personal information about the tertiary institution graduates like, age and senatorial district. Section B consists the items. The statements were rated on a four point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD).

The instrument was reviewed by experts in terms of content, relevance, scope of coverage, language of presentation, clarity of expression and overall adequacy. Based on their comments, some of the items were modified. The sixty-item instrument was then pilot tested in Osun state. The reliability coefficient of the instrument was calculated using Cronbach Alpha's measure. The instrument yielded an average reliability index of 0.79: Career Preparedness = 0.85, Global Employment Awareness = 0.83, Job Market Confidence = 0.81, Industry Connection and Networking = 0.68 and Skill Relevance Perception = 0.78.

Job Sustainability Skills Scale (JSSS)

This is a 15-item researcher's self-developed instrument. It consists of statements concerning the job sustainability skills by tertiary institution graduates. It consists of two sections, A and B. Section A consists of personal information about the tertiary institution graduates like, age and senatorial district. Section B consists the items. The statements were rated on a four point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instrument was reviewed by experts in terms of content, relevance, scope of coverage, language of presentation, clarity of expression and overall adequacy. Based on their comments, some of the items were modified. The fifteen-item instrument was then pilot tested in Osun state. The reliability coefficient of the instrument was calculated using Cronbach Alpha's measure. The instrument yielded an average reliability index of 0.91.

Data Analysis

The data collected for the study were subjected to Pearson product moment correlation to determine the relationship between the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) and sustainability skills after graduation. Multiple regression procedure was used to examine the composite and relative contributions of the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) to the prediction of sustainability skills after graduation.

Having collected Data from the repondents, the result obtained are as follows;

Research Question One: What is the relationship between the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) and sustainability skills after graduation?

Table 1: Correlation matrix showing the relationship between expectations of employment and sustainability skills after graduation

	A	B ₁	B ₂	B ₃	B ₄	B ₅
A	1					
B ₁	0.62*	1				
B ₂	0.86*	0.54*	1			
B ₃	0.76*	0.44*	1.00*	1		
B ₄	0.96*	0.64*	1.00*	1.00*	1	
B ₅	0.01	0.08	0.04	0.04	0.04	1

*denotes significant at 0.05 level of significance

A= Sustainability skills after graduation; B₁= Career Preparedness; B₂= Global Employment Awareness; B₃= Job Market Confidence; B₄= Industry Connection and Networking; B₅= Skill Relevance Perception

The results from table 1 show significant positive relationship between Sustainability skills after graduation and Career Preparedness ($r = 0.62$); Sustainability skills after graduation and Global Employment Awareness ($r = 0.86$); Sustainability skills after graduation and Job Market Confidence ($r = 0.76$) and Sustainability skills after graduation and Industry Connection and Networking ($r = 0.96$). However, there is no significant relationship between Sustainability skills after graduation and Skill Relevance Perception ($r = 0.01$). Besides, it is worth to note that Global Employment Awareness, Job Market Confidence and Industry Connection and Networking had perfect correlation among each other. The implication of this is that, there would be collinear relative contributions of these three variables, it is only one variable that will reveal the relative contributions of the others. This is evident from table 3 where the relative contribution of Industry Connection and Networking overshadowed those of Global Employment Awareness and Job Market Confidence.

Research Question Two: What is the joint contribution of the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) on sustainability skills after graduation?

Table 2: Regression Summary of expectations of employment on sustainability skills after graduation

Model	Sum of Square	df	Mean Square	F	Sig.	Remark
Regression	755.87	3	251.96			
Residual	65.19	86		332.38	0.00	Sig.
Total	821.06	89	0.76			
P < 0.05						
R = 0.96						
R ² = 0.92						
Adj.R ² = 0.92						
Std. Error of the Estimate = 0.87						

The result from table 2 shows that there is a significant joint contribution of expectations of employment to the prediction of sustainability skills after graduation. The table shows the analysis of variance of the regression yielded an ($F_{(3,86)} = 332.38$), it also shows a coefficient of multiple correlation ($R = 0.96$) and an adjusted R^2 of 0.92. This means that 91.8% of the variance in the dependent measure (sustainability skills after graduation) was accounted for by the expectations

of employment when taken together. The remaining 8.2% could be due to errors and other variables.

Research Question Three: What is the relative contribution of the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) on sustainability skills after graduation?

Table 3: Relative contribution of the five expectations of employment to the prediction of sustainability skills after graduation

	Unstandardized Coefficient B	Std. Error	Stand. Coefficient β Contribution	Rank	T	Sig.
Constant	-19.80	0.97			-20.42	0.00
B ₁	0.01	0.02	0.01	2 nd	0.32	0.75
B ₂	-	-	-	-	-	-
B ₃	-	-	-	-	-	-
B ₄	0.76	0.03	0.95	1 st	24.07	0.00
B ₅	-0.12	0.10	-0.04	3 rd	-1.24	0.22

Table 3 reveals the relative contributions of the expectations of employment to the prediction of sustainability skills after graduation. It is revealed that Global Employment Awareness, Job Market Confidence and Industry Connection and Networking had equal (collinearity) largest significant relative contribution to the sustainability skills after graduation ($\beta = 0.95$, $t = 24.07$), followed by Career Preparedness ($\beta = 0.01$, $t = 0.32$), followed by Skill Relevance Perception ($\beta = -0.04$, $t = -1.24$).

Research Question Four: Which of the expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) predicts sustainability skills after graduation most?

Table 3 reveals that Global Employment Awareness, Job Market Confidence and Industry Connection and Networking ($\beta = 0.95$, $t = 24.07$) predict sustainability skills after graduation most and the prediction equation is given by:

$$A = 0.01B_1 + 0.76B_4 - 0.12B_5 - 19.80$$

Discussion of Findings

The findings revealed that expectations of employment (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking and Skill Relevance Perception) had significant composite contribution to the prediction of sustainability skills after graduation. However, the analyses of the relationship between employment expectations and sustainability skills after graduation showed that four (Career Preparedness, Global Employment Awareness, Job Market Confidence, Industry Connection and Networking) out of the five expectations of employment that were investigated had positive significant relationship with sustainability skills after graduation. Besides, Global Employment Awareness, Job Market Confidence and Industry Connection and Networking had equal (collinearity) largest significant relative contribution to the student's achievement in Mathematics, followed by Career Preparedness and Skill Relevance Perception.

This collinearity might be due to the fact that Global Employment Awareness and Job Market Confidence are the premises upon which the Industry Connection and Networking holds. The implication of this is that once there is Global Employment Awareness there must be Job Market Confidence, and the most important thing according to the findings of this study is the potency of the Industry Connection and Networking that follows. The Industry Connection and Networking as the mediating variable between the Global Employment Awareness and the Market Confidence is standing out as an important factor in the sustainability skills after graduation. The implication of this is that the tertiary institution graduates must be conscious of the Global Employment Awareness, Job Market Confidence and Industry Connection and Networking at the instance of sustainability skills after graduation.

The findings are in agreement with the study conducted by Alufohai (2012) where it was discovered that institutions of higher learning all over the world centers for educating, analyzing data, creating information, imparting knowledge which is of utmost importance for development of the future for sustainability in different societies. It also connects with the study conducted by Otoh (2012) who emphasized that higher education is a correlate of socio-economic development and most especially an important procedure in economic growth all over the planet in an attempt to improve productivity, empowerment and social welfarism of citizens.

The findings also agree with that of O'Neill (2010) who postulated that, Universities need to provide their students with opportunities to participate in international, as well as domestic, service learning projects and Students report that these types of volunteer and service learning opportunities provide them with exposure to real world problems and the nonprofit agencies that are working to solve these problems. Wiek et al., (2011) remarked that, futures thinking is also known as anticipatory thinking, foresight, or transgenerational thinking and sustainability requires future thinking which includes the ability to collectively and analyze, evaluate, and craft rich pictures of the future related to sustainability issues and sustainability problem-solving frameworks.

Moreover, the findings aligns with those of Wiek et al., (2011) who said that, system thinking requires that we capture, begin to understand and recognize that a system is a configuration of parts connected and joined together by a web of relationships, flows, and/or network. Jackson (2016) and Stevenson and Clegg (2011) who remarked that, in the global market today, students no longer see the degree itself as sufficient as in this 21st century, employability is more than work skills and is highly linked to students' identity and sense of self, and perseverance in their career across their lifespan.

Conclusion

This study had thus provided a better understanding of the expectations of employment that could influence sustainability skills after graduation. It could be concluded from this study, therefore, that these expectations of employment are very crucial to solving the problem of sustainability skills after graduation in Oyo State. These variables can make or mar the effectiveness of whatever strategies adopted by tertiary institution graduates' search for job in the labour market. If tertiary institution graduates lack the knowledge and adequate application of these factors, they would be restrained in sustainability skills after graduation.

The importance of these variables to the prediction of sustainability skills after graduation point to the fact that tertiary institution graduates need to diversify these expectations of employment towards better job sustainability skills.

Recommendation

It is therefore recommended that tertiary institution graduates possess good knowledge of career preparedness, global employment awareness, job market confidence, industry connection and networking and skill relevance perception in order to have a better control over job sustainability skills.

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ARTIFICIAL INTELLIGENCE (AI) FOR SUSTAINABLE DEVELOPMENT: ASSESSING ITS IMPACT ON TEACHING - LEARNING PROCESS IN PUBLIC TERTIARY INSTITUTIONS IN OYO STATE

**Rebecca Adenike Afolabi (Ph.D) &
Esther Omoniyi Mofoluwawo (Ph.D)**

^{1&2}*Emmanuel Alayande University of Education, Oyo, Oyo State*
afolabira@eauedOyo.edu.ng

Abstract

The research investigated the impact of AI on the teaching-learning process in public tertiary institutions in Oyo State. The research sought to evaluate the impact of integrating AI on lecturers, undergraduates, various challenges and possible solutions. The research design employed was a descriptive survey design. The population consists of all public tertiary institutions in Oyo State. The study was limited to public universities in Oyo State. A simple random sampling technique was used to select all four public universities. Multi stage sampling technique was used to select three faculties from each university making 12 faculties. Simple random sampling was used to select three departments from each faculty making 36 departments. From each department, five lecturers were selected through simple random sampling making a total of 180 lecturers in the selected tertiary institutions. The instrument used for this study was self-developed questionnaire titled “Assessment of Integrating Artificial Intelligence on Teaching and Learning Process for Sustainable Development Questionnaire (AIITLPSDQ)” which was used to collect relevant information on the impact of integrating Artificial Intelligence in the teaching learning process in public tertiary institutions for sustainable development. The reliability of the instrument was ascertained using Cronbach Alpha measure. The reliability Coefficient was found to be 0.71. Simple percentage was used to analyze the data. The findings revealed that integration of AI has impact on both lecturers and undergraduates. It is recommended that there should be training and retraining of lecturers to expose them to how to use AI.

Keywords: Artificial Intelligence (AI), Sustainable development, Impact, Teaching- Learning, tertiary institution

Introduction

Education is a major instrument to transform individuals, communities, society and the nation as a whole. It plays a vital role in economic development of a nation by fostering the absorption of new technologies, enhancing people’s access to knowledge and improving productivity. It raises awareness of potential opportunities, increases labor mobility and contributes to the development of human capital. Investment in education is critical for a country’s economic growth, as it enables individuals to be more innovative, productive and adaptable to scientific advancements and societal changes (Salgür, 2013; Patrinos, 2016)

Artificial Intelligence (AI) has represented one of the most drastic innovations of the 21st century. The role played by innovative technologies has grown gradually in recent years. Technology has changed the structure of education in general; AI has significantly impacted individuals, organizations and societies, it is a technology that aims to solve complex conditions and it has become an essential part of the educational process (Karsenti, 2019; Gocen & Aydemir, 2020). Artificial Intelligence as emerging digital technologies if harnessed effectively could create new

jobs and business opportunities in education, health, trade, and agriculture, among other sectors (African Union, 2020).

The Concept of AI

Artificial Intelligence (AI) can be viewed as the science and engineering behind the evolution of intelligent machines. Artificial Intelligence (AI), according to Gyandeeep (2023) is the discipline of computer science, and its abilities are based on the learning experience that helps increase the chances of accomplishment in solving environmental problems. Artificial Intelligence (AI) relates to the ability of digital computers to perform tasks commonly associated with intelligent beings. Artificial Intelligence (AI) is having a major impact on education due to its rapid development. According to Owoyemi, Owoyemi, Osiyemi, and Boyd (2020) Artificial Intelligence (AI) can be defined as the automation of complex tasks that historically only humans could do, such as decision-making, learning and problem-solving. It has the capacity to enhance precision and effectiveness of human efforts through automated systems. In a nutshell Artificial intelligence (AI) can be defined as a machine that can performed a task intelligently which only human perform. AI has the transformative potential to enhance education and skills development. It provides personalized learning experiences, equipping young people with the skills needed to thrive in a rapidly changing world, and it improves access to quality education.

Artificial Intelligence has the potential to contribute significantly to the attainment of Sustainable Development due to its rapid advancement. It offers different benefits to humankind; every professional must have a vital understanding of sustainable development goals and artificial intelligence and learn to combine these concepts for the advancement of our nation in the future. AI has the potential to address some of the major challenges in education today; it enhances innovative teaching and learning practices, and ultimately hastens the progress towards SDG 4 (United Nations Economic Scientific and Cultural Organization, UNESCO, 2021).

Integrating artificial intelligence in education helps students to enjoy lectures during classes and improves their grades at the same time. Well-trained robots can complement the role of experienced teachers in providing private lessons and additional classes to develop and strengthen students' skills. This technology can also respond to the scarcity of qualified teachers in some fields or solve teachers' problems. However, artificial intelligence is not supposed to replace natural intelligence. The purpose of AI is not to replace teachers in the classroom or dispose of them altogether, but for the human mind to work side by side with the artificial mind in an elaborately calculated combination (Sonetti et al., 2019). The employment of artificial intelligence has brought development to contemporary societies. It is also one of the pillars of educational development in the society. Hence, many countries who have employed artificial intelligence applications in their educational systems, have allowed them to discover new learning frontiers through artificial intelligence in digital systems. It provides an alternative reality for students; it allows students to grow accustomed to confrontation and keep up with modern technology (Chiu & Chai, 2020).

Among the tasks that artificial intelligence performs in the teaching process are correcting exams and evaluating assignments. This reduces the time required for such tasks so that teachers can devote more time to students and classes. Special service options provided by artificial intelligence can help improve students' listening skills during lessons and improve their grades at the same time. Artificial Intelligence may also help teachers develop their abilities and rectify any classroom inadequacies (Chen et al., 2020). The integration of AI will assist the students to take necessary actions to acquire and acclimatize to the future of technology-incorporated jobs. This phenomenon has affected how students think and decide on their careers. The knowledge of AI acquired is a major key of survival for students in this present generation. Instead of changing

their career path due to fear of being replaced by AI, students and institutions are adjusting to the current change of technological advancement. The integration and advancement of AI in cognitive areas has threatened human employment significantly. Starting slow, AI has been advancing rapidly these past few years, overcoming many obstacles, and has proved to be more capable and more intelligent than humans in some areas (Tedrel et al, 2021 and Barabach, 2019).

Purpose of the Study

The aim of this study is to investigate the impact of integrating Artificial Intelligence in education for sustainable development. The objectives are to:

1. investigate the impact of integrating Artificial Intelligence in education on lecturers for sustainable development in public tertiary institutions in Oyo State;
2. access the impact of integrating Artificial Intelligence in education on undergraduates for sustainable development in public tertiary institutions in Oyo State;
3. identify various challenges in integrating Artificial Intelligence in education for sustainable development in public tertiary institutions in Oyo State; and
4. ascertain the way forward to various challenges in integrating Artificial Intelligence in education for sustainable development in public tertiary institutions in Oyo State.

Research Questions

The following questions were raised to guide the study

1. Does the use of Artificial Intelligence empower lecturers and enhance teaching for sustainable development in public tertiary institutions in Oyo State?
2. Does integrating Artificial Intelligence in education impact on undergraduates in public tertiary institutions in Oyo State?
3. What various challenges are faced in integrating AI in education in public tertiary institutions in Oyo State?
4. What are various ways to overcome the challenges in integrating Artificial Intelligence in education in public tertiary institutions in Oyo State?

Theoretical Framework: Constructivism Theory

The integration of artificial intelligence (AI) into tertiary institutions needs a theoretical framework to ensure alignment with education and sustainable goals. For this study Constructivism theory proposed by Jean Piaget was used. This theory posits that learners actively construct knowledge through experiences and reflection, building on prior understanding (Piaget, 1970). AI has the ability to personalized content to individual needs; provide innovative solutions to long-lasting educational challenges, fostering critical thinking and problem-solving skills essential for addressing challenges of sustainable development.

Lamba (2023) reported that Artificial Intelligence technologies provide innovative solutions to long-lasting educational challenges, ranging from personalized learning experiences to efficient administrative management. He stressed further that by leveraging AI-powered adaptive learning platforms, educational institutions can modify instructional content to the needs of individual students, thus fostering enhanced engagement and understanding. Holmes et al. (2019) submitted that the use of AI tools enhance learning has grown exponentially. AI application designed for education was divided into three namely; teacher-facing AI (designed to support teaching), student-facing AI (tools designed to support learning and assessment) and system-facing AI (designed to support the management of educational institutions) (Baker et al., 2019).

Seldon and Abidoye (2018) reported that student-facing AI provide every learner, wherever they are in the world, with access to personalized, high-quality and universal lifelong learning. There is also potential for AI according to Luckin (2017) to facilitate new approaches to valuation, such

as AI-enabled adaptive and continuous assessment. UNESCO (2021) identify some weakness of AI such as its application is highly constrained and limited, it undervalue teachers' unique skills and experience. Bachmman et al. (2022) and Shenkoya and Kim (2023) submitted that AI contribute to achieving the 17 SDGs, implementing data-based policies, making information more reliable, prioritizing actions, supporting better-informed decision-making, and optimizing the allocation of resources.

The implementation of AI in the learning process can yield outstanding results, such as a willingness to use those technologies, less learning anxiety, assistance in the development of student profiles and learning materials that are tailored to each student's abilities and learning preferences and knowledge access (King et al. 2021; Laine et al. 2022; Alhumaid et al. 2023; Hu et al. 2023; Tunjera and Chigona 2023). Riyman and Ali (2023) attested that the use of AI could lead to uneven distribution of knowledge, wealth and power which will not only be present at an individual level, but it would also be concentrated in certain countries and cities, leading to even greater global inequality and hindering progress towards achieving SDG 10 (Reduced Inequalities).

Also, tasks that were formerly limited to human capabilities can now be accomplished faster and better by AI, leading to potential job displacement and psychological stress for humans. They also identified some challenges to effective implementation of the SDGs such as lack of resources, apathy, ignorance, and disinterest, lack of corporations pursuing short-term profits and lack of political will from governments. Hattie (2008) and Bali (2017) reported that AI ignores the importance of the creative and socio emotional aspects of teaching and learning which go beyond mere knowledge acquisition and transmission. Some studies stated the importance of AI as a technological tool with the potential to help overcome challenges and efforts, such as in workplace safety, in health, the economy, education the environment and personalize students' learning HADERER & CIOLACU,2022; AHMAD & ECKERT, 2023; WANG *etal*, 2023a & JAROTA, 2023).

Goralski and Tan (2022) reported that AI tools can identify areas of student difficulty and provide targeted interventions, thereby improving student engagement and outcomes. Rosen (2025) also testified that there are some barriers to the use of AI which include inadequate availability of high quality and unbiased data to support the AI tools, regional inequalities with developing countries receiving less attention regarding AI implementation even though it is for these countries that the need for applying the SDGs is often the most significant, low receptiveness of companies and organizations to adopting AI and a lack of adequate highly skilled workers in AI, problems in detecting inaccurate and biased results generated with AI as well as AI generated misinformation and a lack of policies and governance to avoid or prevent AI-induced problems and rights abuses.

Liao et al. (2022) attested that lack of knowledge and skills of teachers to use AI in teaching is one of the challenges of using AI. Rampasso et al. (2018) testified to some challenges of AI such as scarcity of appropriate and up-to-date teaching materials, lack of teacher training and the insufficiency of infrastructure and available resources. Mahmood, 2022; Yigitcanlar, 2021; Lin & Liu, 2018; Rasheed et al., (2024) also submitted that there are a number of challenges to the use and integration of AI such as unequal access to AI technologies and digital infrastructure, especially by low-income and rural community members.

Concepcion *etal* (2019) submitted that academic community will play a vital role in making future policymakers and business leaders for the negative and positive impacts of AI, which must be taught to students to prepare them for the fast changing world. Ramya and Manju (2019) suggested some solutions to challenges of integrating AI such as government interventions, provision of

resources, structural processes. The implementation of AI in education requires building capacity and enhancing digital literacy among learners, educators, administrators, and policymakers.

BURGER *et al.*, (2023) submitted that there is a fear that AI could replace human critical thinking and knowledge, compromising the ability to make decisions. They stressed further that AI can be used as an instrument to enhance and support human decision-making, not as a substitute for it. Dwivedi *et al.* (2023) also reported that although AI can provide valuable support and information for sustainability education in higher education, it cannot replace the value of human knowledge and experience in the field. Fernandes (2024) reported that AI has a significant role to play in both higher education and sustainable development, it enhances the quality and efficiency of education, it provides personalized and data-driven educational tools and it contributes to the achievement of SDGs. Bulathwela *et al.*, 2021 and Yang *et al.*, (2019) submitted that automation does not lead to job substitution, but rather to a re-allocation of both jobs and tasks in which robots complement and augment human labor by performing routine or dangerous tasks.

Statement of the Problem

The integration of Artificial Intelligence technologies in developed nations provide innovative solutions to long-lasting educational challenges, ranging from personalized learning experiences to efficient administrative management, but in developing countries like Africa, Nigeria in particular Artificial Intelligence has not been fully integrated into the nation's educational system. Higher institutions in Oyo State confront numerous major challenges that affect their functionality and efficiency. Inadequate resources are perhaps the most prevalent, with many institutions facing underfunding, which affects their ability to procure, maintain infrastructure necessary for technology, and retain qualified personnel. The AI has the potential to achieve sustainable development, but, the excessive cost of ICT devices and internet services often exceeds the financial means of individuals and households worsening the digital education. It is observed that countries with higher rates of access to electricity and internet connectivity are more likely to be ready to integrate AI in their education than those with lower access (UNESCO, 2024).

The integration of AI in education in Oyo State faced various challenges such as unreliable electricity, poor internet connectivity, and inadequate infrastructure. Moreover, the high cost of AI tools and a lack of skilled professionals limit the integration of AI in public tertiary institutions. Several studies have examined impact of AI on students' interest, motivation and academic performance however, little or no study focus on impact of AI on lecturers and undergraduates in public tertiary institutions. Thus, this study focus on impact of integrating AI on teaching learning process in public tertiary institutions in Oyo State.

Methodology

Descriptive survey research design was adopted for the study. The population consists of all public tertiary institutions in Oyo State. The study was limited to public universities in Oyo State. There are ten public tertiary institutions in Oyo State. Simple random sampling technique was used to select all the four public universities.

Multi stage sampling technique was used to select three faculties from each university making 12 faculties. Simple random sampling was used to select three departments from each faculty making 36 departments. From each department, five lecturers were selected through simple random sampling making a total of (180) one hundred and eighty lecturers in the selected tertiary institutions. The instrument used for this study was self developed questionnaire titled "*Assessment of Integrating Artificial Intelligence on Teaching and Learning Process for Sustainable Development Questionnaire (AIITLPSDQ)*" which was used to collect relevant information on the impact of integrating Artificial Intelligence in teaching learning process in

public tertiary institutions for sustainable development in Oyo State. The instrument was anchored on 4 point Likert Scale rating of Strongly Agree (SA), Agree (A), Disagree (D) to Strongly Disagree (DA). The instrument is divided into two sections; sections A seek information on the demographics of the respondents such as gender, academic qualifications, years of teaching experience, age. Section B contains information on the assessment of impact of integrating Artificial Intelligence in education for sustainable development in Oyo State. The validity of the instrument was guaranteed by subjecting it to thorough scrutiny by experts in the Department of Educational Management and Department of evaluation. The reliability of the instrument was ascertained using Cronbach Alpha and the reliability coefficient was 0.71. The data were collected and analyzed using simple percentage. The instrument was administered and collected by the researcher and two research assistants. Data collected were analyzed using descriptive statistics like frequency counts and percentages.

Analysis of Results

Answering Research Questions

Research Question 1: Does the use of Artificial Intelligence empower lectures and enhance teaching?

Table1: Percentage of respondents on IMPACT OF Artificial Intelligence on lecturers

S/N	ITEMS	SA	%	A	%	D	%	SD	%
1.	It reduces lecturers' work load	78	43.3	95	52.8	07	3.9	-	
2.	It offers professional development resource	106	58.9	72	40	02	1.1	-	
3.	It can be used to track students' performance / progress over time	92	51.1	85	47.2	03	1.7	-	
4.	It can be used to track students' performance / progress over time								
	online teaching learning process	111	61.7	68	37.8	01	0.5		
5.	It reduces time consuming activities on the part of lecturers	53	29.4	123	68.4	04	2.2		

Table 1 revealed that lecturers agreed that integration of AI reduces their workloads (43.3% strongly agreed, 52.8% agreed). A large numbers of lecturers agreed that integration of AI offers professional development resources (58.9% strongly agreed, 40% agreed). The table also revealed that integration of AI can be used to track students' performance and progress over time with 51.1% strongly agreed and 47.2% agreed respectively. The table further revealed that integration of AI assist to engage in collaborative learning opportunities and online teaching-learning process (61.7 % strongly agreed, 37.80% agreed). The result also revealed that majority of lecturers agreed that integration of AI reduces time consuming activities (29.4% strongly agreed, 68.4% agreed).

Research Question 2: Does integrating Artificial Intelligence in education impact on undergraduates in Oyo State public tertiary institutions for sustainable development?

Table 2: Percentage of respondents on impact of Artificial Intelligence on undergraduates in public tertiary institutions in Oyo State

S/N	ITEMS	SA	%	A	%	D	%	SD	%	
1.	It offers personalized instruction by providing access to knowledge	53	29.4	122	67.8	03	1.7	2	1.1	
2.	It can be used to monitor students' attention and homework	29	16.1	145	80.6	04	2.2	2	1.1	
3.	It has potential to analyze learners' personal needs	42	23.3	133	73.9	05	2.8	-	-	
4.	It reduces anxiety among learners and predict which students are at risk of failure		62	34.4	107	59.4	07	3.9	4	2.2
5.	It has ability to identify when students are bored and confused during teaching learning process	23	12.8	153	85	04	2.2			

Result from table 2 revealed that integration of AI offers personalized instruction and knowledge to undergraduates with 29.4% strongly agree and 67.8% agree respectively. The table further revealed that the integration of AI can be used to monitor students' attention and homework with 16.1% strongly agree, 80.6% agree respectively. The result also revealed that majority of the lecturers agreed that integration of AI has potential to analyze learners' personal needs with 23.3% strongly agree and 73.9% agree respectively. Majority of the lecturers agreed that integration of AI reduces anxiety among learners and predict which students are at risk of failure with 34.4% strongly agreed and 59.4% agreed respectively. A large numbers of lecturers agreed that integration of AI has ability to identify when students are bored and confused during teaching learning process with 12.8% strongly agree, 85% agree).

Research Question 3: What various challenges are faced by lecturers in integrating Artificial Intelligence in education for sustainable development?

Table 3: Percentage of respondents on various challenges faced by lecturers in integrating Artificial Intelligence in education for sustainable development

S/N	ITEMS	SA	%	A	%	D	%	SD	%
1.	It avoids lecturers' social roles in teaching and learning process	41	22.8	138	76.7	01	0.5	-	-
2.	Lack of AI technologies and digital infrastructure	76	42.2	104	57.8	-	-	-	-
3.	Its application is tightly constrained and limited	19	10.6	138	76.7	13	7.2	10	5.5
4.	It under values lecturers' unique skills, experiences and Socio-emotional aspects of teaching and learning		52	28.9	128	71.1	-	-	-
5.	Lecturers may not have competencies to enable them work with AI		81	45	94	52.2	05	2.8	-

Table 3 revealed that many lecturers agreed that integration of AI avoids lecturers' social roles in teaching and learning process which is the major ingredient in effective teaching-learning process with(22.8% strongly agree, 76.7% agree). A large numbers of lecturers agreed that Lack of AI

technologies and digital infrastructure is also a challenge to integration of AI (42.20% strongly agreed, 57.8% agreed). It also revealed that majority of the lecturers agreed that application AI is tightly constrained and limited (10.6% strongly agree, 76.7% agree). The result also revealed that many lecturers agreed that integration of AI under values lecturers' unique skills, experience and socio-emotional aspects of teaching and learning (28.90% strongly agree, 71.1% strongly disagree). Majority of the students agreed to work with public sector (39.16% disagree, 53.60% agree). The result also revealed that majority of the lecturers may not have competencies to enable them work with AI (45% strongly agree, 94% agree) respectively.

Research Question 4: What are various ways to overcome various challenges in integrating Artificial Intelligence in education for sustainable development?

Table 4: Percentage of respondents on various ways of overcoming various challenges in integrating Artificial Intelligence in education for sustainable development

S/N	ITEMS	SA	%	A	%	D	%	SD	%
1.	Training and retraining of lecturers	36	20	144	80	-	-	-	-
2.	Provision of adequate internet facilities	28	15.6	152	84.4	-	-	-	-
3.	Provision of AI technologies and digital infrastructure	61	33.9	119	66.1	-	-	-	-
4.	Provision of interrupted power supply	69	38.3	111	61.7	-	-	-	-
5.	Provision of appropriate and up-to-date teaching materials	53	29.4	127	70.6	-	-	-	-

Result from table 4 revealed that majority of the lecturers agreed that with training and retraining of lecturers is essential for integration of AI 20% strongly agreed and 80% agreed respectively. The result of the findings also revealed that lecturers agreed that provision of adequate internet facilities is required for integration of AI with 15.6% strongly agreed and 84.4% agreed. The result further revealed that provision of AI technologies and digital infrastructure is necessary for integration of AI with 33.9% strongly agreed and 66.1% agreed. The result also revealed that the lecturers that provision of interrupted power supply is required for integration of AI with 38.3% strongly agree and 61.7% agree. The result also revealed that majority of lecturers agreed that there should be provision of appropriate and up-to-date teaching materials with 29.4% strongly agreed and 70.6% agreed respectively.

Discussion of Findings

The result from table 1 revealed the impact of integrating AI on teaching learning process. Majority of the lecturers agreed that integration of AI reduces workloads, it offers professional development resources, it can be used to track students' performance / progress over time and online teaching learning process, and it reduces time consuming activities on the part of lecturers. The result of the findings is in line with Chen et al (2020) who submitted that Artificial Intelligence help teachers to develop their abilities and rectify any classroom inadequacies. In collaboration to the findings Luckin (2017) attested that AI has potential to facilitate new approaches to valuation, such as AI-enabled adaptive and continuous assessment. Dwivedi et al. (2023); Fernandes (2024) and Goralski and Tan (2022) also reported that AI can provide valuable support and information for sustainability education in higher education, it enhances the quality and efficiency of education, it provides personalized and data-driven educational tools and it can identify areas of student difficulty and provide targeted interventions, thereby improving student engagement and outcomes.

The result from table 2 revealed the impact of integration of AI on undergraduates, majority of the lecturers agreed that AI provides personalized instruction to undergraduates, it can be used to monitor students' attention and homework, It has potential to analyze learners' personal needs, It reduces anxiety among learners and predict which students are at risk of failure. The findings of the study corroborate the findings of Lamba Solutions (2023) reported that Artificial Intelligence technologies provide innovative solutions to long-lasting educational challenges, ranging from personalized learning experiences to efficient administrative management. This is related to the position of Constructivist theory about students' engagement in constructive model and that AI has ability to personalized content to individual needs. The educational institutions can also modify instructional content to the needs of individual student, thus fostering enhanced engagement and understanding. King et al. 2021; Laine et al. 2022; Alhumaid et al. 2023; Hu et al. 2023; Tunjera and Chigona 2023) also attested that implementation of AI in the learning process can yield outstanding results, such as a willingness to use those technologies, less learning anxiety, assistance in the development of student profiles and learning materials that are tailored to each student's abilities and learning preferences and knowledge access.

The result of the findings revealed various challenges to integration of AI such as it avoids lecturers' social roles in teaching and learning process, it under values lecturers' unique skills, experiences and Socio-emotional aspects of teaching and learning , its application is tightly constrained and limited and lack of AI technologies and digital infrastructure among others. The finding reflect the opinion of UNESCO (2021); Riyman and Ali (2023); Rampasso et al. (2018); Rosen (2025) who identified some weakness of AI such as its application is highly constrained and limited, it undervalue teachers unique skills and experience, lack of resources, apathy, ignorance, disinterest, scarcity of appropriate and up-to-date teaching materials, lack of adequate highly skilled workers in AI, lack of teacher training and the insufficiency of infrastructure and available resources. Hattie (2008) and Bali (2017) attested that AI ignores the importance of the creative and socio emotional aspects of teaching and learning which go beyond mere knowledge acquisition and transmission. Liao et al. (2022) attested that lack of knowledge and skills of teachers to use AI in teaching is one of the challenges of using AI.

The result of the findings also revealed various solutions to the challenges of integrating AI which include training and retraining of lecturers, provision of adequate internet facilities, provision of AI technologies and digital infrastructure, provision of interrupted power supply and provision of appropriate and up-to-date teaching materials. The finding is in line with Ramya and Manju (2019) who suggested some solutions to challenges of integrating AI such as

government interventions, provision of resources, structural processes, education requires building capacity and enhancing digital literacy among learners, educators, administrators, and policymakers.

Conclusion

The integration of AI reduces workloads, it offers professional development resources, it can be used to track students' performance / progress over time and online teaching learning process and it reduces time consuming activities on the part of lecturers, provides personalized instruction to undergraduates, it can be used to monitor students' attention and homework, it has potential to analyze learners' personal needs, It reduces anxiety among learners and predict which students are at risk of failure. The findings also revealed various challenges to integration of AI such as it avoids lecturers' social roles in teaching and learning process, it under values lecturers' unique skills, experiences and Socio-emotional aspects of teaching and learning, its application is tightly constrained and limited and lack of AI technologies and digital infrastructure among others. Some solutions were suggested such as training and retraining of lecturers, provision of adequate internet facilities, provision of AI technologies and digital infrastructure, provision of interrupted power supply and provision of appropriate and up-to-date teaching materials.

Recommendations

Based on the findings of the study the following recommendations were made:

There should be regular training and retraining of teachers through various professional developments to expose lecturers to how to use AI for effective teaching-learning process. The regular training of lecturers will enhance their effectiveness.

State Government should provide adequate internet facilities to enhance teaching and learning in public tertiary institutions in the state. Without adequate internet facilities AI cannot function without its function there could not be quality of instructional delivery and this will affect the quality of learning in public tertiary institutions in the state.

AI technologies and digital infrastructure are capital intensive therefore, State Government should provide adequate fund to procure these infrastructure. Adequate funding will go a long way in the provision of appropriate and up-to-date teaching materials and provision of interrupted power supply and.

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AWARENESS, ATTITUDE AND UTILISATION OF ARTIFICIAL INTELLIGENCE TOOLS AMONG UNDERGRADUATES EDUCATION STUDENTS IN PUBLIC UNIVERSITIES IN OSUN STATE, NIGERIA

¹Sunmola Kadiri Adegoke (Ph.D), ²Olufunmiso Olatunbosun Ajala (Ph.D),

³Kehinde Olugbenga Aluko (Ph.D),

⁴Yemisi Adeola Ayoola (PhD),

⁵Adekemi Olufunke Akanbi (Ph.D), &

⁶Ogechi Rita Osuala (Ph.D)

Department of Science, Technology and
Mathematics Education,
Faculty of Education,
University of Ilesa, Osun State, Nigeria
adegokekadiri@gmail.com;

Abstract

This study investigates the awareness, attitude and utilisation of artificial intelligence tools among the undergraduate education students in public universities in Osun State, Nigeria. This study adopted a descriptive survey design to examine the awareness, attitude, and utilisation of Artificial Intelligence (AI) tools among undergraduates in the Faculty of Education at Obafemi Awolowo University (OAU), Nigeria and University of Ilesa (UNILESA), Nigeria. The population for this study consisted of all undergraduates students of all public Universities in Osun State, Nigeria. A sample of 245 students obtained through Taro Yamane Formula consisting of 140 students of Obafemi Awolowo University and 105 students of University of Ilesa, Nigeria was used. Four objectives with their corresponding research questions were raised and analysed using both the descriptive and inferential statistics. The descriptive statistics used for the data analysis were frequency and percentage distribution, mean, standard deviation and relative impact index (RII) while the one-sample t-test was the inferential statistics used. The findings revealed that students have a high level of awareness about artificial intelligence (AI) (Group mean 23.19, $t = 40.326$, $p < 0.05$). Also, students exhibited positive attitudes about using AI in learning (Group mean = 22.52, $t = 37.848$, $p < 0.05$), feeling comfortable using AI-powered tools to learn concepts (mean = 3.21) and confident in their ability to navigate these tools. The result also showed that AI tools are widely utilised among students in academic routines. The popular challenges against the use of AI by the students include High cost of AI tools such as Android phones (mean = 3.40, RII = 0.85), lack of data due to its high cost (mean = 3.38, RII = 0.85) and reduction of meaningful interaction with classmates and teachers by the use of AI (mean = 3.24, RII = 0.81), among others. It is highly recommended that AI literacy training should be introduced into courses in teacher education and the University should provide campus-wide internet and AI tools subscriptions for improved accessibility.

Keywords: Awareness, Attitude, Utilisation, Artificial Intelligence Tools, University Undergraduates

Introduction

The rapid advancement of Artificial Intelligence (AI) is transforming various aspects of modern life, including education. AI tools refer to software applications that utilize artificial intelligence technologies, such as machine learning, natural language processing, and expert systems, to

perform specific tasks. These tools can range from simple chatbots to complex systems that analyse data and make decisions. The definition of AI tools is multifaceted, encompassing a range of key aspects.

According to Afolabi and Ojo (2022), AI tools are defined as software applications that leverage artificial intelligence technologies to execute specific tasks. These tools have the potential to significantly enhance efficiency and productivity across various sectors. In a like manner, Oladapo and Adeyemo (2021) defined AI tools as software applications that harness artificial intelligence technologies to perform specific tasks, enhancing efficiency and productivity in various sectors.

The applications of AI tools are diverse, spanning customer service, healthcare, finance, and education. A primary benefit of AI tools is their potential to significantly enhance students' ability to boost efficiency and productivity. By automating routine tasks and providing data-driven insights, organizations can streamline operations and make informed decisions, leading to improved outcomes and a competitive edge. In education, AI-powered systems provide personalized learning experiences, enhance learning outcomes, and increase access to education. They assist teachers in creating effective instructional strategies and foster creativity and critical thinking skills in students.

The Integration of AI tools in undergraduate education has numerous benefits, transforming the learning experience in profound ways. According to recent studies by Kopczynski and Silvia (2024), Schei, Møgelvang and Ludvigsen (2024), Ebnu-Saifudin, Anwar, Hashim and Kurniawan (2024), Falebita and Kok (2024), and Stohr, Ou and Malmström (2024), AI tools have been found to significantly enhance the academic experience of undergraduate students and prepare them for future careers. These tools offer numerous benefits, including personalized learning experiences, improved research efficiency, and individualized guidance. By leveraging AI-powered platforms, students can access tailored learning materials, receive support with challenging concepts, and benefit from tools that aid organization and time management. Additionally, AI tools can facilitate career development, skill-building, and accessibility. They can provide career guidance, help students develop skills in data analysis and programming, and offer support for students with disabilities.

However, AI tools also have some demerits to consider. Over-reliance on AI can hinder the development of critical thinking and problem-solving skills, while biased AI systems can perpetuate existing inequalities. Moreover, AI-generated content may lack originality and creativity, potentially affecting the quality of academic work. Additionally, security risks associated with AI tools can compromise sensitive student data, and dependence on AI may lead to diminished research and analytical skills. These drawbacks highlight the need for balanced and responsible AI integration in undergraduate education.

Review of Literature

Tala, Bira & Tala (2024) conducted a study on business students' awareness and perceptions of generative AI. The findings revealed that business and tourism undergraduate students showed a high level of awareness about generative AI models. Students also expressed a desire to explore generative AI technologies, indicating a positive attitude towards AI integration in education. Similarly,

In another study, Faqih and Al-Sharafi (2024) investigated undergraduate students' perceptions and awareness of AI-based tools: A case study on ChatGPT. The findings reported that external factors significantly influence user acceptance of ChatGPT among undergraduate students.

On the attitude of undergraduates towards the use of AI, AlAhmad (2024) conducted a study to explore undergraduates' attitudes towards ChatGPT: Is AI Resistance Futile? The findings revealed that 55.9% of students have a positive attitude towards AI chatbots in education. The findings further showed that students were concerned about the impact of AI Chatbots on learning, with 20.5% expressing worries about its effects on students' learning.

With respect to the usage of AI tools among Nigerian undergraduates, Kwon and Lee (2024) conducted a study to identify patterns in AI tool usage among STEM (Science, Technology, Engineering and Mathematics) academics and undergraduates, with a focus on strategic goals for AI integration. The research revealed distinct patterns in AI tool usage, categorizing them into three strategic goal patterns: performance, innovation, and collaboration. Their findings provide valuable insights into how AI tools are utilized in STEM education, highlighting the diverse approaches to AI integration.

Furthermore, Falebita and Kok (2024) conducted a study to explore the relationship between undergraduates' technological readiness, self-efficacy, attitude, and usage of AI tools, providing insights into the factors influencing AI adoption among Nigerian students. The findings revealed the following: (a) undergraduates' confidence in using technology significantly influences their usage of AI tools and perception of ease of use, (b) students' preparedness to adopt new technologies affects their perception of AI tools' usefulness, ease of use, and self-efficacy, and (c) undergraduates' attitudes are the primary determinant of AI tool usage, highlighting the importance of fostering positive attitudes towards AI in education. In addition, Olasina and Akintola (2024) conducted a study on artificial intelligence tools usage: a structural equation modelling of undergraduates' technological readiness, self-efficacy, attitude, and usage. The findings revealed a significant relationship between technological readiness, self-efficacy, attitude, and usage of AI tools.

Looking into the challenges of students on the students' use of AI tools, Nwodu (2025) investigated awareness and perception of the use of AI for learning among select communication undergraduates in Nigeria. Findings revealed that 82% of communication students surveyed reported no access to AI tools. Only 10% considered themselves competent in using AI for learning. While they generally perceive AI as beneficial, actual use is limited by lack of access and skills.

In the same manner, Olatunji-Ishola, Onwuegbuzie, and Okanlawon (2025) also conducted a study on the risks and rewards of AI dependence in Nigerian Education. It was found out that participants across universities expressed concerns about over-reliance on AI, describing it as a threat to critical thinking and academic authenticity. The study identified broader challenges such as digital inequality, including high costs of devices and unreliable internet access.

Despite the growing importance of AI in education, there is a notable lack of comprehensive research on the usage patterns of AI tools among undergraduate students. In addition, there is limited research on students' perceptions of the challenges they face in using them for academic tasks. This study addressed these gaps by investigating not only the usage patterns of AI tools among undergraduates in public universities but also assessing the perceived challenges of using AI tools in academic tasks. Gaining insight into undergraduates' usage patterns and the challenges they encounter with AI tools can provide valuable insights and contribute to the development of effective strategies for AI integration in education among undergraduates in public universities.

Research Objectives

The research objectives of this study are to:

1. Investigate the level of awareness of AI tools among undergraduate students in public universities.
2. Examine undergraduate students' attitude towards AI-powered tools in educational settings.
3. Determine the usage patterns of AI tools among undergraduates' students in enhancing their academic tasks and responsibilities; and
4. Assess the perceived challenges of using AI tools in academic tasks among students.

Research Questions

The following research questions were raised:

1. What is the level of awareness of AI tools among undergraduate students in public universities?
2. What are undergraduate students' attitudes towards AI-powered tools in educational settings?
3. What are the usage patterns of AI tools among undergraduates in enhancing their academic tasks and responsibilities?
4. What are the perceived challenges faced by students in using AI tools for academic tasks?

Methodology

This study adopted a descriptive survey design to examine the awareness, attitude, and utilization of Artificial Intelligence (AI) tools among undergraduates in the Faculty of Education at Obafemi Awolowo University (OAU) and University of Ilesa (UNILESA). The population for this study consisted of all undergraduates students of all public Universities in Osun State, Nigeria. A sample of 245 students obtained through Taro Yamane Formula consisting of 140 students of Obafemi Awolowo University, Nigeria and 105 students of University of Ilesa, Nigeria was used. A multistage sampling technique was employed. In the first stage, the two public universities were purposively selected. In the second stage, the Faculty of Education was selected from each institution. In the third stage, departments within each faculty were stratified, and in the final stage, students were randomly selected from each stratum to ensure fair representation. Data were collected using a structured, validated questionnaire with sections on demographics, awareness, attitude, and utilization of AI tools, rated on a 4-point Likert scale. The instrument's reliability was confirmed using Cronbach's alpha. Data were analysed using descriptive statistics (frequency, mean, percentage) and inferential statistic (one-sample t-test) to determine whether the mean score of the sample differs significantly from the expected population mean.

Results

The descriptive statistics of frequency and percentage distribution, and mean and standard deviation were used to examine each objective. The relative impact Index (RII) was added to the descriptive statistics used for objective 4. In addition, the one-sample t-test, an inferential statistic was used further in examining objectives 1 and 2. The frequency and percentage distribution shows the distribution of the responses of the students to the seven items in each of the sections B, C, D, E, which were to elicit responses that would enable the examination of objectives 1. 2. 3. 4. respectively. Responses to each item was on a 4-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD).

In each section, the responses on a four-point Likert scale were coded as strongly agree (SA) 4, Agree (A) 3, Disagree (D) 2, Strongly disagree (SD) 1 for items stated in the positive direction favouring the variable under consideration. The score of each student was the total score that the

student obtained from the coding of his/her responses to items 1-7 of each section of the questionnaire. Since each item has a minimum score of 1 and maximum score of 4 than the minimum obtainable score of any student in each section was $1 \times 7 = 7$ while the maximum score was $4 \times 7 = 28$. The mean and standard deviation for the sample of 245 students were calculated from their scores.

Level of Awareness of AI Tools Among Undergraduate Students (Objective 1)

The first objective of the study was to investigate the level of awareness of AI tools among undergraduate students in public universities

This objective was examined in two stages. In the first stage, the scores of the respondents in the seven items in the section B of the questionnaire (which sought to know the level of awareness of the respondents about AI tools) were tagged their 'Awareness Scores'. The responses and Awareness Scores were subjected to descriptive analysis and the results are shown in table 1.

Table 1: Descriptive Statistics of Responses of Respondents to Items Relating To Awareness of AI Tools

S/N	ITEM	LEVEL OF AGREEMENT				TOTAL f (%)	$\bar{X}$	SD
		SA f (%)	A f (%)	D f (%)	SD f (%)			
1.	I have heard about Artificial Intelligence (AI) tools used in education.	159 (64.9)	78 (31.8)	5 (2.0)	3 (1.2)	245 (100)	3.60	.596
2.	I know the names of some AI tools (e.g., ChatGPT, Grammarly, QuillBot)	119 (48.6)	100 (40.8)	22 (9.0)	4 (1.6)	245 (100)	3.36	.715
3.	I understand what AI tools are used for in academic work.	127 (51.8)	99 (40.4)	15 (6.1)	4 (1.6)	245 (100)	3.42	.683
4.	My friends or classmates talk about AI tools.	118 (48.2)	103 (42.0)	19 (7.8)	5 (2.0)	245 (100)	3.36	.715
5.	My lecturers or instructors have mentioned AI tools in class.	108 (44.1)	99 (40.4)	30 (12.2)	8 (3.3)	245 (100)	3.36	.795
6	I follow social media or websites that talk about new AI tools.	92 (37.6)	91 (37.1)	42 (17.1)	20 (8.2)	245 (100)	3.04	.936
7.	I can list at least three AI tools that students use in school.	95 (38.8)	97 (39.6)	46 (18.8)	7 (2.9)	245 (100)	3.14	.820
GRAND MEAN = 3.33								

The table 1 showed the frequency and percentage distribution of the responses together with the means and the standard deviations of the students' Awareness Scores in each of the seven items measuring level of awareness. The table shows that the level of awareness was high as indicated by the analysis of each item and in general. For example, table 1 shows that 159 (64.9%) strongly agreed with the statement "I have heard about artificial intelligence (AI) tools used in education", 78 (31.8%) agreed, 5 (2%) disagreed, while 3 (1.2%) strongly disagreed. That is, a majority total of 237 (159+78) or 96.7% agreed with this statement while 8 (5+3) or 3.3% disagreed with the statement. The mean students' awareness score for the item was 3.60 which was far greater than 2 the mid value of scale 1 to 4. Thus the result indicated that the student did not only agreed strongly in majority that they had heard about artificial intelligence (AI) tools used in education, their level of awareness of the AI tools was high (mean = 3.60).

The table also showed that 119 (48.6%) strongly agreed with the statement “I know the names of some AI tools (e.g., ChatGPT, Grammarly, QuillBot)”, 100 (40.8%) agreed, 22 (9%) disagreed, while 4 (1.6%) strongly disagreed. That is, a majority total of 219 (119+100) or 89.4% agreed with this statement while 26 (22+4) or 10.6% disagreed with the statement. The mean students’ awareness score for the item was 3.36 which was far greater than 2 the mid value of scale 1 to 4. Thus the result indicated that the student did not only agreed strongly in majority that they know the names of some AI tools (e.g., ChatGPT, Grammarly, QuillBot), their level of awareness (knowledge) of the AI tools was high (mean = 3.36) The table showed the same results for all the seven items in section B, including the last item, item 7.

Table 1 further showed that 95 (38.8%) strongly agreed with the statement “I can list at least three AI tools that students use in school.”, 97 (39.6%) agreed, 46 (18.8%) disagreed, while 7 (2.9%) strongly disagreed. That is, a majority total of 192 (95+97) or 78.4% agreed with this statement while 53 (46+7) or 21.6% disagreed with the statement. The mean students’ awareness score for the item was 3.14 which was far greater than 2 the mid value of scale 1 to 4. Thus the result indicated that the students did not only agreed strongly in majority that they can list at least three AI tools that students use in school., their level of awareness of the AI tools in term of listing some AI tools was high (mean = 3.14). In terms of variability of the items, the table shows that responses to item 6 “I follow social media or websites that talk about new AI tools”, have the greatest variability (SD) = 0.936, while “ I have heard about Artificial Intelligence (AI) tools used in education” had the list variability with standard deviation .596. That the standard deviation for all the seven items were very close suggested a reasonable level of consistency in the responses of the students. The grand mean of 3.33 which is greater than 2 (half of 4) also showed that the level of awareness of AI tools by the students was high in general

In the second stage the awareness scores of all the students were subjected to one-sample t-test. The one-sample t-test is a robust inferential statistics which was to complement the descriptive statistics in determining the level of awareness of AI tools by the students and at the same time tells whether or not the obtained level is significant or merely due to chance. The test score for the one-sample t-test was 14, which was half of the maximum score of 28. Result of the one sample t-test is presented in table 2. All calculations were done in SPSS 25.

Table 2 : One sample t-test analysis of the level of awareness of AI tools by the respondents

	N	Mean	SD	t-value	df	p
Awareness of AI tools	245	23.19	3.568	40.326*	244	.000

*Significant at probability level 0.05 ($P < 0.05$).

Table 2 showed that the sample mean 23.19 was significantly greater than the test value (average score) 14. That is, the result shows that the level of awareness of AI tools among the undergraduates was significantly high. The result of the one-sample t-test, therefore did not only agreed with that of the descriptive statistics , but showed further that the high level of awareness obtained was significant, that is, was not obtained by chance.

Undergraduate Students Attitudes Towards AI-Powered tools in Educational Settings (Objective 2)

The second objective of the study was to examine undergraduate students’ attitude towards AI-Powered tools in educational settings. The relevant data collated from responses of students to section C of the questionnaire which bothered on the attitude of the students towards AI- powered tools in educational settings were collated and presented in table 3.

Table 3: Descriptive Statistics of Responses of Respondents to Items Relating to Attitude Toward AI Tools

S/N	ITEM	LEVEL OF AGREEMENT				TOTAL f (%)	$\bar{X}$	SD
		SA f (%)	A f (%)	D f (%)	SD f (%)			
1.	I believe AI tools can help improve my academic performance	128 (52.2)	99 (40.4)	17 (6.9)	1 (0.4)	245 (100)	3.44	.642
2.	I am comfortable using AI tools to support my school work.	80 (32.7)	139 (56.7)	23 (9.4)	3 (1.2)	245 (100)	3.21	.654
3.	I think AI tools make learning easier	112 (45.7)	104 (42.4)	26 (10.6)	3 (1.7)	245 (100)	3.33	.713
4.	I feel worried that using AI tools can aid cheating.	85 (34.7)	86 (35.1)	47 (19.2)	27 (11.0)	245 (100)	2.93	.990
5.	I trust the information given by AI tools.	77 (31.4)	106 (43.3)	55 (22.4)	7 (2.9)	245 (100)	3.03	.809
6.	I would like to learn more about how to use AI tools properly.	118 (48.2)	100 (40.8)	23 (9.4)	4 (1.6)	245 (100)	3.36	.719
7.	I believe AI tools should be allowed in schools with proper guidance.	113 (46.1)	90 (36.7)	25 (10.2)	17 (6.9)	245 (100)	3.22	.892
GRAND MEAN = 3.22								

Table 3 showed that 128 (52.2%) strongly agreed with the statement “I believe AI tools can help improve my academic performance”, 99 (40.4%) agreed, 17 (6.9%) disagreed, while 1 (0.4%) strongly disagreed. That is, a majority total of 227 (128 + 99) or 92.7% agreed with this statement while 18 (17+1) or 7.3% disagreed with the statement. The mean students’ attitude score for the item was 3.44 which was far greater than 2 the mid value of scale 1 to 4. Thus the result indicated that the student did not only agreed strongly in majority that they believe AI tools can help improve their academic performance, the level of their attitude towards the use of AI tools was positive and high (mean = 3.44). Similarly, 80 (32.7%) strongly agreed with the statement “I am comfortable using AI tools to support my school work”, 139 (56.7%) agreed, 23(9.4%) disagreed while 3 (1.7%) strongly disagreed. That is, a majority total of 219 (80 + 139) or 89.4% agreed with this statement while 26 (23+3) or 10.6% disagreed with the statement. The mean students’ attitude score for the item was 3.33 which was far greater than 2 the mid value of scale 1 to 4. Thus the result indicated that the student did not only agreed strongly in majority that they were comfortable using AI tools to support their school work, the level of their attitude towards the use of AI tools was positive and high(mean = 3.21).

The table also showed that the students agreed with the statements “ I think AI tools make learning easier for me” (mean = 3.33), “I trust the information given by AI tools” (mean = 3.03), and “I would like to learn more about how to use AI tools” (mean = 3.36), and “I believe AI tools should be allowed in schools with proper guidance” (mean = 3.22). However, the students responses to item 4 “I feel worried that using AI tools can aid cheating” in this same section appeared to run contrary to their responses to the other items. In particular, 171 (85 + 86) or 69.8%) agreed with this statement which portrays negative attitude, while 74 (47 + 27) or 30.2 %) disagreed. The mean

of 2.93 however still portrait a fairly good attitude. The grand mean of 3.22, which is greater than 2 (half of 4) also showed that the level of attitude of the students towards the use of AI tools in academic setting was positive and high in general.

Further, the one-sample t-test for the data in this section (section C) was conducted. The result was presented in table 4.

Table 4 : One sample t-test analysis of the Undergraduate Attitudes towards AI - powered Tools

	N	Mean	SD	t-value	df	p
Attitudes towards AI tools	245	22.52	3.525	37.848	244	.000

*Significant at probability level 0.05 ($P < 0.05$).

Table 4 shows that the sample mean 22.52 was significantly greater than the test value (average score) 14. That is, the result showed that the level of undergraduate students' attitudes towards the use of AI tools was significantly high and positive. This result did not only confirm that of the descriptive statistics in table 3 but showed that the high level of the students attitude towards the use of AI obtained by the descriptive statistics was not due to chance.

Usage patterns of AI tools among undergraduates' students (Objective 3)

The responses to the seven items relating to the usage pattern of AI tools by the undergraduates students were collated. The descriptive statistics are presented in table 5.

Table 5: Descriptive Statistics of Responses of Respondents to Items Relating to Utilisation of AI Tools

S/N	ITEM	LEVEL OF AGREEMENT				TOTAL f (%)	$\bar{X}$	SD
		SA f (%)	A f (%)	D f (%)	SD f (%)			
1.	I have used AI tools to write or improve my assignments.	123 (50.2)	109 (44.5)	9 (3.7)	4 (1.6)	245 (100)	3.43	.647
2.	I use AI tools to search for answers or summaries when reading.	121 (49.4)	100 (40.8)	23 (9.4)	1 (0.4)	245 (100)	3.39	.673
3.	I use AI tools regularly for school-related work.	101 (41.2)	107 (43.7)	26 (10.6)	11 (4.5)	245 (100)	3.22	.809
4.	I use different AI tools for different academic purposes	96 (39.2)	104 (42.4)	31 (12.7)	13 (5.3)	245 (100)	3.32	2.681
5.	I ask AI tools to help me understand difficult topics.	111 (45.3)	98 (40.0)	28 (11.4)	8 (3.3)	245 (100)	3.27	.791
6.	I use AI tools mostly during exam or test preparation	71 (29.0)	107 (43.7)	42 (17.1)	25 (10.2)	245 (100)	2.91	.930
7.	I use AI tools more often than traditional study methods (e.g., textbooks, group study).	77 (31.4)	95 (38.8)	55 (22.4)	18 (7.3)	245 (100)	2.94	.913
GRAND MEAN = 3.21								

Table 5 showed that 123 (50.2%) strongly agreed with the statement "I have used AI tools to write or improve my assignments", 109 (44.5%) agreed, 9 (3.7%) disagreed, while 4 (1.6%) strongly disagreed. That is, a majority total of 232 (123 + 109) or 94.7% agreed with this statement while 13 (9+4) or 5.3% disagreed with the statement. The mean students' Utilisation Score for the item was 3.43 which was far greater than 2 the mid value of scale 1 to 4. Thus the result indicated that the students did not only agreed strongly in majority with the statement "I have used AI tools to write or improve my assignments", their level of utilization of the AI tools was high. This trend was the case for all the items. For example, responses to item 5, "I ask AI tools to help me understand difficult topics" showed that a total of 209 (111 + 98) or 85.3% agreed with this

statement, while 36 (28 + 8) or 14.7% disagreed, with mean 3.27. This thus, showed that majority of the students agreed that they ask AI tools to write or improved their assignments, and the level of utilisation for this purpose was high (mean = 3.27). The grand mean of 3.21 which is greater than 2 (half of 4) also showed that the level of utilization of AI tools by the students was high in general when all the items in that section were considered together.

Perceived Challenges of Using AI Tools in Academic Tasks Among Students (Objective 4)

The fourth objective of the study was to assess the perceived challenges of using AI tools in academic tasks among students.

The responses of the students to the seven listed perceived challenges in section E of the questionnaire were analyzed. The results were presented in table 6 with the relative impact index (RII).

Table 6: Descriptive Statistics of Responses of Respondents to Items Relating to Perceived Challenges of Using AI Tools

S/N	ITEM	LEVEL OF AGREEMENT				TOTAL f (%)	$\bar{X}$	SD	RII	RANK
	To what extent do you agree with each of the following as a challenge to the use of AI tools by students	SA f (%)	A f (%)	D f (%)	SD f (%)					
1.	High cost of AI tools such as Android phones	127 (51.8)	95 (38.8)	18 (7.3)	5 (2.0)	245 (100)	3.40	.716	0.85	1st
2.	Students usual struggle to deeply understand topics when using AI tools.	88 (35.9)	105 (32.9)	43 (17.6)	9 (3.7)	245 (100)	3.11	.820	0.78	4th
3.	Lack of data due to its high cost	93 (38.0)	119 (48.6)	21 (8.6)	9 (3.7)	245 (100)	3.38	2.600	0.85	2nd
4.	Wrong or confusing answers from AI tools.	86 (35.1)	37 (39.6)	47 (19.2)	15 (6.1)	245 (100)	1.96	.889	0.49	6th
5.	Poor internet access.	64 (26.1)	112 (45.7)	45 (18.4)	24 (9.8)	245 (100)	2.12	.909	0.53	5 th
6.	The use of AI tools hinders creativity.	89 (36.3)	109 (44.5)	31 (12.7)	16 (6.5)	245 (100)	1.89	.862	0.47	7 th
7.	The use of AI tools reduces meaningful interaction with classmates and teachers.	104 (42.4)	104 (42.4)	25 (10.2)	10 (4.1)	245 (100)	3.24	.799	0.81	3 rd
GRAND MEAN = 2.73										

Table 6 showed that 127 (51.8%) strongly agreed with the statement “High cost of AI tools such as Android phones often hinder its use by students”, 95 (38.8%) agreed, 18 (7.3%) disagreed,

while 5 (2.0%) strongly disagreed. That is, a majority total of 222 (127 + 95) or 90.6% agreed with this statement while 23 (18+5) or 9.4% disagreed with the statement. The mean score for the item was 3.40 which was far greater than 2, the mid value of scale 1 to 4. Thus the result indicated that the students did agreed in majority that High cost of AI tools such as Android phones was a challenge to the use of AI tools by the students. Other factors that were considered as challenges include students usual struggle to deeply understand topics when using AI tools (mean 3.11), Lack of data due to its high cost (mean 3.38), Poor internet access (mean 2.12), among others. The grand mean of 2.73 which is greater than 2 (half of 4) and closer to 3 also showed that the students agreed that the stated factors, in general were challenges to the students' use of AI tools.

The relative strength of the challenges were indicated by the relative impact index. Two factors, High cost of AI tools such as Android phones and Lack of data due to its high cost had the same RII of 0.85. However, high cost of AI tools such as Android phones was rated first as the strongest challenge due to its higher mean of 3.40 compared with 3.38 of Lack of data due to its high cost which was rated second. 'That the use of AI tools reduces meaningful interaction with classmates and teachers' with RII 0.81 was rated third, and so on. That the use of AI tools hinders creativity, with RII 0.47 was considered the weakest challenge.

Discussion of Findings

The findings of this study indicate that most students are familiar with general-purpose AI tools such as ChatGPT and Grammarly, while awareness of subject-specific AI applications remains relatively low. This result aligns with the study by Tala, Bira, and Tala (2024), which reported a high level of awareness of generative AI models among business and tourism undergraduates. Similarly, Faqih and Al-Sharafi (2024) found that undergraduate students demonstrate considerable awareness and acceptance of ChatGPT. However, a slight variation emerges when compared with the findings of Kwon and Lee (2024), who observed that STEM students exhibit more strategic and diverse use of AI tools, including familiarity with subject-specific applications tailored to enhance performance, innovation, and collaboration. This suggests that students in certain disciplines may have greater exposure to specialized AI tools than the general undergraduate population captured in this study. Furthermore, the majority of respondents agreed that AI is helpful, enhances productivity, and should be integrated into teacher training programmes to promote effective use. This aligns with the findings of AlAhmad (2024), who reported that 55.9% of undergraduates expressed positive attitudes towards the use of AI chatbots in education, despite some concerns about their potential effects on learning. Additionally, the studies by Falebita and Kok (2024) and Olasina and Akintola (2024) further support this result, revealing that students' positive attitudes, technological readiness, and self-efficacy significantly influence their perceived usefulness of AI tools and their willingness to adopt them for academic tasks.

Regarding the level of utilization, this study found that AI tools are used moderately by students, primarily for completing assignments and generating summaries. This pattern is consistent with Faqih and Al-Sharafi (2024), who noted that undergraduate students readily accept ChatGPT for routine academic tasks. However, Kwon and Lee (2024) highlighted that STEM students tend to integrate AI more extensively and use it for a broader range of purposes beyond basic assignments, indicating a more strategic application. This contrast underscores that while general awareness and positive attitudes towards AI are widespread, the depth and scope of AI tool usage may vary considerably across disciplines and contexts.

Finally, concerning the perceived challenges of using AI tools, majority of students acknowledged that excessive reliance on AI could lead to machine dependency. They also identified the high

cost of devices such as smartphones and persistent network issues as significant barriers. These findings closely parallel those of Nwodu (2025), who found that many undergraduates struggle to use AI effectively due to high device costs and inadequate digital readiness, and Olatunji-Ishola, Onwuegbuzie, and Okanlawon (2025), who reported that students often fear becoming overly dependent on AI while also facing infrastructural limitations.

Conclusion

This study reveals that while undergraduates widely embrace general-purpose AI tools like ChatGPT and Grammarly, awareness and strategic use of subject-specific applications remain limited. Students value AI's ability to enhance productivity but are cautious about overdependence, with high device costs and poor internet access posing real barriers. These findings highlight both promise and gaps: awareness is high, but depth of use and equitable access must improve. To fully unlock AI's benefits in education, stakeholders must invest in affordable infrastructure, targeted training, and a culture of responsible, critical use. Ultimately, AI should not replace human thinking but empower students to learn, create, and innovate beyond what machines alone can achieve.

Recommendations

Based on the findings of this study, it could be recommended that:

1. Universities should incorporate both general-purpose and subject-specific AI tools into curricula to deepen students' knowledge and practical skills across fields.
2. Teacher education programmes should include comprehensive training on effective and ethical use of AI tools, so educators can guide students properly.
3. Policymakers and institutions should subsidize smart devices and expand affordable, reliable internet access to reduce financial and infrastructural barriers for students.
4. Awareness campaigns and workshops should help students balance AI use with critical thinking, creativity, and academic honesty, to avoid overdependence.
5. Faculties should motivate students to explore AI beyond routine tasks by supporting AI-driven research, projects, and problem-solving activities.

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IMPACT OF ONLINE LEARNING ENVIRONMENTS ON THE ACADEMIC PERFORMANCE OF STUDENTS WITH LEARNING DISABILITIES IN LAGOS STATE, NIGERIA: AN ANALYTICAL STUDY

¹Feyisetan Christianah Toyin (Ph.D) & ² Olubanke Adeleye Olaojo (Ph.D)

¹Emmanuel Alayande University of Education, Oyo, Oyo State.
Faculty of Specialized and Professional Education,
Department of Special Education and Guidance and Counselling

²Federal College of Education Special Oyo
School of Education
Department of Educational Psychology
feyisetan11@gmail.com

Abstract

Online learning platforms have transformed education, yet their effectiveness for students with learning disabilities remains uncertain. Challenges such as limited accessibility, inadequate teacher support, and poorly structured digital environments hinder academic success. This study examines the extent to which accessibility of online learning platforms and teacher support influence students' academic performance in Lagos State, Nigeria. A quantitative research design was employed, utilising structured questionnaires to collect data from students in Lagos State. Three hypotheses were tested using statistical methods to assess the significance of relationships and contributions of the independent variables. Findings indicate a significant relationship between accessibility, teacher support, and academic performance. Both variables jointly contribute to learning success, with teacher support emerging as the stronger predictor. Students with learning disabilities benefit from structured digital learning, assistive technologies, and enhanced teacher-student interactions. Digital learning can enhance academic performance when accessibility and teacher support are prioritised. However, neglecting inclusive strategies may widen educational disparities. Policymakers and educators should integrate assistive technologies, enhance teacher training for online instruction, and establish student support systems. Future research should investigate the long-term impact of digital learning on diverse student populations.

Keywords: Online Learning, Accessibility, Teacher Support, Academic Performance, Digital Education, Learning Disabilities.

Introduction

Although education is a basic right, institutional and socioeconomic hurdles still create gaps in academic achievement among children with learning challenges. Studies (Breen & Jonsson, 2005; Broer, 2019) reveal that students with impairments have more difficulty in traditional and digital classrooms, resulting in lower educational results than their ordinarily developing colleagues (Eide et al., 2010; Esch et al., 2014). Students with cognitive and mental illnesses most clearly display these disparities since they generally suffer from information retention, engagement, and adaptation to new learning situations (Nordmo et al., 2022). The advent of online education has offered flexibility and accessibility to many learners. However, students with disabilities continue to confront difficulties. Many online learning systems lack inclusive resources, including screen readers, subtitles, and adaptive tools, making understanding harder (Ally, 2019). Further academic

obstacles emerge from constrained instructor support in virtual settings, consequently compromising personalised learning experiences (Smith & Arnett, 2021). With an eye towards a more inclusive digital education system, this research analyses how accessibility and instructor help impact the academic achievement of students with learning disabilities in online learning situations.

Usually indicated by grade point averages (GPA), standardised test outcomes, and course completion rates (Jensen et al., 2021), academic performance is a primary measure for judging educational attainment. Students' academic performance is impacted by several aspects, including socioeconomic background, cognitive capacity, school environment, and instructional quality (Breen & Jonsson, 2005; Broer et al., 2019). Research consistently demonstrates that differences in academic success are grounded in unequal access to educational resources, teacher help, and technological developments (Eide et al., 2010). Lower socioeconomic background pupils generally suffer because of insufficient family support, financial restraints, and restricted access to learning tools (Reiss, 2013). Furthermore, key factors in learning outcomes include psychological and environmental ones, including classroom engagement, social interactions, and motivation degrees (Rivera & Tilcsik, 2024). While traditional learning spaces provide organised instruction, the expanding movement towards digital education poses crucial challenges regarding the accessibility and usefulness of online learning, particularly for students with disabilities.

For individuals with learning disabilities, academic hurdles are significantly more visible. These youngsters often have trouble in information processing, working memory constraints, and lower reading comprehension, making it tougher to stay up with scholastic requirements (Nordmo, 2022). Consequently, individuals are likely to have inferior GPA scores, increased dropout rates, and less self-efficacy compared to their typically developing peers (Chatzitheochari & Platt, 2019). Furthermore, social obstacles, stigma, and inadequate teacher preparation aggravate these educational disparities, preventing kids with impairments from gaining the required academic aid (Jensen et al., 2021). Studies have indicated that personalised teaching strategies, assistive learning tools, and one-on-one mentorship may drastically enhance knowledge and retention for these individuals (Bacolod et al., 2018). As the education sector gradually adopts digital learning platforms, it becomes vital to assess whether online education effectively satisfies the requirements of students with disabilities or just accentuates their present challenges.

Empirical research on online education and learning challenges has yielded diverse outcomes. Some studies suggest that online learning enables flexibility, allowing students to learn at their own speed while minimising classroom-related stress (Mgutshini, 2013; El Refae et al., 2021). However, other studies indicate considerable drawbacks, including lower engagement, absence of direct instructor interaction, and restricted access to assistive learning technologies (De Freitas et al., 2015; Mohammadian et al., 2021). Bacolod et al. (2018) detected no significant changes in academic performance between online and conventional learning environments but noticed that students with lower pre-existing GPAs suffered more in digital settings. Additionally, retention rates tend to be poorer for students with disabilities in online courses, as a lack of structured support, additional distractions, and technological obstacles restrict their learning efficacy (Smith & Arnett, 2021). These findings underscore the necessity of inclusive digital learning techniques, expanded accessible features, and strong teacher support to overcome the achievement gap for students with impairments in online education. Thus, while digital learning has the potential to democratise education, assuring its efficacy for all students, particularly those with cognitive problems, remains a serious challenge.

Moreover, the quick growth of online learning platforms has radically revolutionised the educational environment, enabling improved accessibility and flexibility for a broad spectrum of students. Digital education enables individualised learning, enabling students to engage with course information at their speed. However, the value of these platforms in enhancing academic accomplishment varies, particularly for individuals with learning challenges. While online learning removes geographical and temporal limits, numerous aspects such as student participation, motivation, and the availability of academic aid play crucial roles in determining academic achievement. Sánchez Elvira Paniagua and Simpson (2018) stress that intrinsic motivation is a crucial component influencing students' commitment to academic accomplishment. Similarly, research performed in Australia by Stone (2019) finds that online learners frequently differ demographically from conventional on-campus students, as they tend to be older, more experienced, and usually handle major family commitments. These demographic discrepancies affect their motivational drivers, subsequently altering their capacity to succeed in virtual learning contexts.

Beyond motivation, intellectual engagement is another important determinant of accomplishment in online education. Chen (2005) studied the link between students' opinions of academic support and their educational achievement, revealing that perceived support from professors, peers, and parents boosts commitment to learning. Likewise, Gasiewski et al. (2012) acknowledged a lack of engagement as a critical factor leading to dropout rates in science-related disciplines, finding that students were more interested when instructors actively participated in their learning. Britto and Rush (2013) underlined that student retention in online education is closely connected to prior experience with digital learning. Their study at Lone Star College-Online indicated that help desks, personalised teaching, and interactive technologies dramatically increase academic outcomes. Reinforcing this, Rotar (2022) stressed that the timing of academic aid is crucial since well-timed interventions increase overall learning effectiveness. At a wider level, Sánchez-Elvira Paniagua and Simpson (2018) revealed that European institutions are increasingly prioritising online learning support to enhance student retention and satisfaction, eventually hurting academic success.

Research has increasingly focused on the barriers faced by students with learning disabilities in online education. While digital learning platforms have the flexibility to accommodate varied learning requirements, empirical data demonstrate that accessible features, instructional design, and institutional support considerably impact academic performance among students with impairments. Abou-Khalil et al. (2021) found that digital engagement strategies, such as screen sharing, recorded lectures, and summarised lessons-positively improve student motivation. However, Lamanauskas et al. (2021) found that intrinsic motivation in online learning is typically lower than in conventional education, with differences caused by geographical and socio-economic variables. In Turkey, Mese and Sevilen (2021) demonstrated that poorly designed online learning environments drastically reduce student motivation, particularly among those needing more learning support. Similarly, studies in West Java by Widiyanti et al. (2021) demonstrated that online education fosters a lifelong learning attitude, particularly when students recognise the value of their courses. These scholars further established that academic engagement, self-motivation, and digital literacy are considerably associated with student achievement in online contexts. Additionally, studies by El-Sayad et al. (2021) in Egypt suggested that academic self-sufficiency has a key impact on student commitment, while displaying strong institutional support boosts student retention and success rates among students with learning challenges.

Teacher-student interaction (TSI) refers to the way teachers and students relate within their learning environments (Englehart, 2009). Given the reciprocal nature of relationships, interactions play a critical part in relationship formation. The classroom climate and the quality of TSI substantially impact how well teacher-student relationships flourish healthily (Lampi, 2006). Positive TSI is crucial for high-quality teaching and learning, fostering a feeling of community (Wubbels & Levy, 1993; Liberante, 2012), and enhancing student motivation. In an online learning environment, restricting physical connection creates hurdles in developing rapport and customising engagement with students. This component is particularly significant, since excellent communication correlates to greater academic achievement and overall success (Harper, 2018), while ensuring that students feel comfortable and secure in virtual classrooms is critical for encouraging meaningful engagement and effective learning.

As facilitators in online classrooms, teachers fill multiple roles, including developing instructional content, delivering courses, and regulating student interactions in digital environments (Garrison, 2003). To be effective, teachers must comprehend students' issues, barriers, and particular learning needs in an online learning environment. TSI must thus be prioritised to ensure a positive learning experience. Research has indicated that online student engagement is highly determined by the instructional strategies employed by teachers. For instance, Martin and Bolliger (2018) discovered that the more involved students feel, the more joyful they become, which enhances their motivation to study and improves their academic accomplishment. Effective course design and interactive learning activities adapted to student requirements can drastically enhance participation (Dixson, 2010). However, research on secondary school TSI in online classrooms, particularly in the Singaporean setting, remains limited.

Empirical studies underscore the vital role of teacher aid in the online learning experiences of students with learning challenges. Research demonstrates that students' opinions of their learning environment greatly impact their academic engagement and performance. Maulana et al. (2015) proved that studying students' perceptions produces a more accurate prediction of learning outcomes than external observations or teacher-reported instructional actions. Additionally, students' attitudes and behaviours are significantly affected by their impressions of their learning environment, which plays a key factor in determining their academic progress. Moreover, variables such as social, psychological, and educational experiences impact students' perceptions, which in turn affect their learning approaches and outcomes (Fraser, 1998). (Tootoonchi, 2016) further suggested that students' perceptions of their learning environment greatly determine the quality of their academic achievement.

In the context of students with learning challenges, research underlines unique concerns in online education. Abou-Khalil (2021) demonstrated that digital engagement strategies, such as screen sharing, recorded lectures, and summarised courses, significantly boost student motivation. However, Lamanauskas (2021) reported that intrinsic motivation tends to be lower in online education, changing based on geographical and socio-economic parameters. Similarly, Mese and Sevilen (2021) revealed that poorly designed online learning environments negatively impact student motivation, particularly among those seeking more learning aid. Additionally, Ferrer et al. (2022) and Robayo-Tamayoa et al. (2020) found a substantial correlation between academic engagement, self-motivation, and digital literacy in impacting students' academic progress in online environments. Furthermore, they underlined that academic self-sufficiency substantially influences student commitment, while Netanda et al. (2019) observed that effective institutional assistance enhances retention and success rates.

Despite the worldwide transformation in education through online learning, students with learning disabilities (LD) in Nigeria remain disadvantaged. Existing research mainly focuses on general student populations, overlooking accessibility limits, engagement concerns, and institutional

support deficiencies for LD students in digital environments. Research from developed nations emphasises assistive technology and structured support networks, while little is known about how these factors affect academic attainment in Lagos State, where digital infrastructure and socio-economic realities differ. Limited teacher training, poorly accessible technologies, and socio-economic hurdles may further exacerbate educational disparities for LD students in online learning. This study bridges the gap by examining the effect of online education on LD students' academic achievement, identifying impediments, and providing evidence-based measures for a more inclusive digital learning system in Nigeria.

Hypotheses

H₀₁: There is no significant relationship between the accessibility of online learning platforms, teacher support during online learning, and students' academic performance in Lagos State, Nigeria.

H₀₂: Accessibility of online learning platforms and teacher support during online learning do not jointly influence students' academic performance in Lagos State, Nigeria.

H₀₃: Accessibility of online learning platforms and teacher support during online learning do not have a significant relative contribution to students' academic performance in Lagos State, Nigeria.

Methods

This study employed a descriptive survey research design employing the ex-post facto approach to analyse the impact of the accessibility of online learning platforms and teacher help during online learning on students' academic attainment in Lagos State, Nigeria. The research population included school students, and 250 respondents were randomly chosen from diverse schools. The research aimed to acquire relevant data to test hypotheses on the relationship between the independent and dependent variables. By examining these characteristics, the study intended to offer empirical insights into how digital learning environments influence students' academic progress. The findings were anticipated to help educational policymakers, school administrators, and instructors in boosting online learning accessibility and teacher-student engagement to increase student performance in Lagos State.

To reach this goal, three proven research techniques were utilised. The Academic Success Scale (APS), a 20-item test, was created to assess students' perceived academic accomplishment. Responses were scored on a five-point Likert scale, ranging from strongly agree (5) to strongly disagree (1). Sample items were "I felt confident in my ability to succeed in online learning" and "Online learning helped me improve my grades." The scale's dependability was validated using the split-half technique, achieving a correlation value of $r = 0.87$. The second instrument, the Online Learning Accessibility Questionnaire (OLAQ), consisted of 15 self-report items evaluating students' perceptions of online learning accessibility, with sample statements such as "I had reliable internet access for online learning" and "The online learning platform was easy to use and navigate." The reliability coefficient for this scale was $r = 0.72$.

The third instrument, the Teacher Help Scale (TSS), has 20 items aimed to measure students' opinions of teacher support during online learning. Sample items were "My teachers provided timely feedback on my assignments" and "My teachers actively engaged with students during online classes." The scale's reliability coefficient was established at $r = 0.89$. Data were collected from students across diverse backgrounds and analysed using Pearson Product-Moment Correlation (PPMC) and Linear Multiple Regression to determine the relationships, joint contributions, and relative contributions of the independent variables (accessibility of online

learning platforms and teacher support during online learning) to the dependent variable (students' academic performance). The findings offered significant insights into the effectiveness of online learning environments and their effects on academic accomplishments in secondary schools in Lagos State.

Results

Hypothesis 1: There is no significant relationship between the accessibility of online learning platforms, teacher support during online learning, and students' academic performance in Lagos State, Nigeria.

Table 1: Zero Order Correlation Matrix showing the relationship between Independent Variables and Dependent Variable in the study.

Variables	N	Mean	SD	1	2	3
Academic Performance	250	63.46	11.29	1.000		
Online Learning Accessibility	250	75.70	6.978	0.437**	1.000	
Teacher Support	250	59.13	6.311	0.020	0.432**	1.000

Correlation: Significant at $p < 0.05$

Table 1 shows the composite contribution of all the independent variables (accessibility of online learning platforms and teacher support) to the dependent variable (students' academic performance). The results indicate that academic performance was positively correlated with online learning accessibility ($r = 0.437^{**}$, $p < 0.01$) and teacher support ($r = 0.020$, $p > 0.05$). Therefore, the null hypothesis is rejected in favour of the alternative hypothesis, concluding that there is a significant relationship among the independent variables and students' academic performance in Lagos State.

Hypothesis 2: Accessibility of online learning platforms and teacher support during online learning do not jointly influence students' academic performance in Lagos State, Nigeria.

Table 2: Showing the joint contribution of the independent variables on the dependent variable (students' academic performance) in Lagos State.

Multiple R = 0.570 R-Square = 0.325 Adj. R-Square = 0.306 Standardized error of estimate = 9.4011					
Model	Sum of Squares	Df	Mean Squares	F	Sig.
Regression	10315.858	2	1473.694	16.674	0.000
Residual	21388.242	247	88.381		
Total	31704.100	249			

Table 2 shows the composite contribution of all the independent variables to the dependent variable. That is, students' academic performance correlated positively with the two independent variables. The table also shows a coefficient of multiple correlations (R) of 0.570 and an adjusted R^2 of 0.306. This means that 30.6% of the variance in students' academic performance is accounted for by all the independent variables. The significance of the joint contribution was tested at $P < 0.05$ using the F-Test at a degree of freedom ($df = 2, 247$). The table also shows that the analysis

of variance for the regression yielded an F-ratio of 16.674, significant at the 0.05 level ($F(2,247) = 16.674, p < 0.05$).

Hypothesis 3: Accessibility of online learning platforms and teacher support during online learning do not have a significant relative contribution to students' academic performance in Lagos State, Nigeria.

Table 3: Regression Analysis of Relative Contribution of Online Learning Accessibility and Teacher Support to Students' Academic Performance in Lagos State.

	Unstandardized coefficients	Standardized coefficients			
Model	B	Standard Error	Beta	T	P
Constant	33.825		3.664	0.000	0.000
Online Learning Accessibility	0.893	-0.552	8.575	0.000	0.000
Teacher Support	-0.341	-0.191	-3.267	0.001	0.001

Table 3 reveals the relative contributions of the independent variables (accessibility of online learning platforms and teacher support) to the dependent variable (students' academic performance), expressed in Beta weights. The partial correlation coefficient of accessibility of online learning platforms and teacher support with academic performance is shown. The positive value of the contribution of online learning accessibility implies that students' academic performance was enhanced. Using the standardized regression coefficient to determine the relative contribution of the independent variables, the following were obtained: online learning accessibility ($\beta = 0.552, t = 8.575, P = 0.000 < 0.05$) and teacher support ($\beta = -0.191, t = -3.267, P = 0.001 < 0.05$) respectively.

Discussion of Findings

This study evaluated if there is a significant connection between the independent variables (access to online learning platforms and teacher support during online learning) and students' academic progress in Lagos State, Nigeria. The statistics demonstrate a considerable connection between these parameters, confirming past studies. Empirical studies have indicated that accessibility to digital learning platforms has a critical influence on students' academic engagement and performance (Sánchez-Elvira Paniagua & Simpson, 2018). Online platforms that give organised aid, assistive technology, and flexible learning schedules increase students' capacity to acquire and recall content (Mgutshini, 2013; El Refae et al., 2021). However, challenges such as poor digital literacy, lack of stable internet access, and absence of tailored instructional design negatively impact student performance (Mohammadian et al., 2021).

Furthermore, teacher aid is vital in improving academic success, as proved by studies demonstrating the usefulness of interactive teaching techniques and timely interventions in digital classrooms (Martin & Bolliger, 2018; Britto & Rush, 2013). In contrast, findings also reveal that students with learning disabilities encounter considerable issues in online education. Studies by Abou-Khalil et al. (2021) suggest that digital engagement strategies, such as recorded lectures and screen-sharing tools, significantly boost students' motivation. However, Lamanauskas et al. (2021) observed that intrinsic motivation tended to be poorer in online environments, which could further limit academic accomplishment. Research in Turkey by Mese and Sevilen (2021) also

underlined that badly designed online environments significantly influence student motivation, especially among those seeking more learning aids. These findings underscore the relevance of digital inclusion and well-structured instructional frameworks to ensure that students, regardless of their learning capacity, may succeed in online education.

Additionally, the study evaluated whether accessibility to online learning platforms and teachers helps jointly contribute to students' academic achievement. The results demonstrate a considerable joint contribution, supporting prior findings that stress the value of institutional aid in enhancing student retention and success rates (Netanda et al., 2019). Online learning platforms, when supported with strong institutional backing, coordinated support systems, and individualised interventions, considerably boost learning results (El-Sayad et al., 2021). This highlights the importance for educators and policymakers to implement inclusive digital learning strategies that accommodate various student requirements.

Furthermore, the study analysed the relative significance of accessibility to online learning platforms and instructor help to students' academic progress. The findings suggest that these variables greatly affect academic accomplishment, supporting research by Chen (2005) and Gasiewski et al. (2012), which revealed teacher support as a major driver of academic engagement. The study by Rotar (2022) further verifies this, emphasising that well-timed academic interventions greatly increase students' overall learning effectiveness. Thus, our findings underline the importance of a balanced approach to digital education, ensuring that accessibility features and teacher-student interactions are properly integrated to enhance student achievement.

Conclusion

This study demonstrates that accessibility to online learning platforms and teacher support considerably boost students' academic attainment in Lagos State, Nigeria. Findings demonstrate that digital learning environments, when properly designed and supplied with needed support mechanisms, contribute to increased learning outcomes. However, challenges such as restricted accessibility, lack of teacher-student relationships, and insufficient aid for students with learning impairments remain key concerns that must be addressed to achieve equitable education for all learners.

Additionally, while online education has the potential to democratise learning, its success is contingent upon the degree of support and accessibility supplied. The study underlines the significance of proactive institutional efforts to embrace digital inclusion, interactive teaching approaches, and assistive learning aids in online education. Addressing these traits helps bridge the achievement gap and enhance student retention and success rates in digital learning contexts.

Recommendations

Based on the findings, the following recommendations are proposed:

1. **Enhancing Digital Accessibility:** Policymakers and educational institutions should invest in expanding the accessibility of online learning platforms by ensuring consistent internet connectivity, user-friendly interfaces, and adaptive learning aids for students with impairments.
2. **Strengthening Teacher Support:** Educators should be offered professional development training on successful digital teaching approaches, including personalised interventions, interactive lesson delivery, and real-time academic aid to improve student engagement.

3. Developing Inclusive Learning Strategies: Online education platforms should feature assistive technology, such as text-to-speech software, screen readers, and configurable learning modules, to accommodate students with learning disabilities.
4. Improving Student Engagement: Institutions should establish structured support systems, including virtual mentorship programs, peer learning groups, and academic advising, to assist students in remaining motivated and interested in digital learning.
5. Institutional Support and Policy Implementation: Government and educational authorities should create policies that encourage equitable access to online learning resources and provide financial aid or subsidised internet connection for students in low-income neighbourhoods. **By applying these criteria, education can create an inclusive, supportive, and accessible online learning space.**

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LEADERSHIP, SCHOOL ADMINISTRATION AND THE OUTPUT OF TEACHERS AND STUDENTS IN PUBLIC AND PRIVATE SECONDARY SCHOOLS IN BAYELSA STATE, NIGERIA

Grace Barinaada Ibaba (Ph.D)

Department Of Educational Management

Niger Delta University, Wilberforce Island, Bayelsa State

graceibaba@ndu.edu.ng

Abstract

This paper looked at the measured outcomes of school leadership strategies on the productivity of educators in public and private secondary schools in Bayelsa State, Nigeria. Based on Max Weber's bureaucratic theory, the study employed a correlational survey design, collecting data from principals and teachers in two schools. The two schools, Community Comprehensive Secondary School (CSS), Agbura, a public school, and Belary Schools, a private school, are situated in the Yenagoa metropolis of the state capital. A framework survey format called the Academic Performance Questionnaire (TSAQ) was utilised. The outcome reveals a significant correlation between headship style or leadership pattern and the productivity of teachers in both private and public schools. However, it showed that owned schools exhibited more structured bureaucratic features. The study recommends capacity-building programmes, seminars, and consultant-led training sessions for school leaders to improve administrative effectiveness in public schools.

Keywords: Effectiveness, performance, public and private schools, educational leadership, school administration

Introduction

With the advances of the world, the focus on transformational leadership in the educational system, the headship of academic institutions in the 21st century continues to develop. Enormous appreciation for the outstanding critical role leadership has played in creating opportunities for teachers and students to achieve quality performance and academic success (Leithwood, Harris, & Hopkins, 2020). According to the OECD (2016), effective leadership is a global phenomenon that fosters positive knowledge in education, creating a steady room for improvement and advancement. School leadership must implement changes that bring about distinction and prestige in the citadel of learning.

Classical theorists, such as Taylor, Fayol, and Weber, made significant contributions to the evolution of management practices. Institutional leadership and strategic guidelines, as discussed by Adegboyega (2013) and Bush (2015). These guides explain vital and relevant key issues, taking into account the changes happening in institutional conduct and the impact of headship in school organisations. Bush (2015) identifies Max Weber's bureaucratic model as one of the foundational theories of organisational behaviour, which remains relevant for understanding hierarchical structures and authority in schools. Weber's model underscores the importance of rules, roles, and rationality in ensuring organisational effectiveness. The work of Max Weber supports the crucial concepts of guidance, responsibility, and justification in achieving institutional impact in attaining goals and objectives. In educational leadership, excellent headship develops through a steady commitment to learning, training, self-examination, and ongoing knowledge acquisition. While influencing abilities and good human relations are essential for impactful leadership, the principal

should also possess the technical and management skills required (Amanchukwu, Stanley, and Ololube, 2015). They inspire and mobilise stakeholders toward the achievement of collective objectives, whereas ineffective leaders can hinder institutional progress.

Headship patterns play a vital role in institutional gains and advancement. Drucker (2001) and Naylor (1999) outline the exceptional qualities a school manager should possess, including sincerity of purpose, foresight, and a clear understanding of the school's goals and mission, which aids in the selection of frameworks, guidelines, outcomes, as well as educational approaches, methods, and strategies. The academic manager with foresight provides room for learners to adjust to transformations and growth, enabling them to meet the needs of the educational system and prevent obstacles and difficulties as a leader. The investigation by Cuthbert (1984) grouped theories and guidelines into five classes, namely, logical reasons, Administrative reasons, functional reasons, human reasons, and experiential reasons. These groups, as studied by Cubert, explain and offer solutions to institutional guidelines and regulations in educational leadership. Within this theoretical context, the present study investigates the influence of leadership theories on the effectiveness of educational leaders in Bayelsa State. Specifically, it seeks to explore how organisational theory, particularly Weber's bureaucratic model, informs leadership practices and impacts teacher and student outcomes in public and private secondary schools.

Statement of the Problem

Institutional headship plays a critical role in influencing the productivity of learning and teaching procedures to achieve efficiency in educational goals and objectivity. For a positive result, as shown in the work of Leithwood, Harris & Hopkins (2020) and Bush (2023), educational headship has a clear impact on teachers' effectiveness. School leadership has a direct impact on teacher morale, instructional quality, institutional culture, and student outcomes. Effective leadership ensures that the school vision and mission align with classroom practices, thereby creating a conducive environment for learning and professional development. This creates an environment that fosters a supportive learning atmosphere, enhancing the capacity for expertise growth and advancement. But the framework, pattern implementation and operations are different in practices from one developing nation to another, especially in Nigeria, which is characterised in forms of schools and design after a change in political interests in educational institutions (Odukoya, 202; Eze & Agba, 2023)

Although there has been development in the world study on educational leadership, the impact of Max Weber on the functionality of bureaucratic guidelines remains minimal in the Nigerian academic system, particularly in the context of educational training, spread, and delivery of leadership. Weber's bureaucratic principles, including clearly defined hierarchies, formalised rules and procedures, impersonal decision-making, career orientation, and division of labour, constitute foundational elements of efficient and accountable school management. Effective and responsible school heads (Weber, 1974; Peretomode, 2008; Bush, 2015) posit that if rigidly applied, the Weberian theory is unavailable (Fejia, 2014). On the other hand, privately owned secondary schools operate with a planned administrative guidelines system, in line with Max Weber's principles. Thus, private organisations implement transparent procedures that are task-oriented in performance, with leadership approach that ensures rules and regulations are followed

and obeyed. Moreover, their strict adherence to the guideline principle of Max Weber provides reasons for better results and outcomes in academic productivity and educator punctuality.

Existing scholarship on educational leadership in Nigeria has concentrated mainly on infrastructural limitations, funding gaps, and teacher recruitment challenges. While these are undoubtedly important, there is insufficient attention paid to how internal leadership structures, particularly those informed by organisational theory, influence school effectiveness (Okorie, 2011; Amanchukwu, Stanley & Ololube, 2015). The scarcity of comparative studies examining the effectiveness of public and private school leadership through the lens of Weberian theory is a noticeable gap in educational research, particularly in Bayelsa State.

Given these gaps, the present study is situated within the broader discourse on school improvement and educational reform in Nigeria. It seeks to interrogate how leadership approaches, specifically, the presence or absence of bureaucratic principles, impact teacher effectiveness and student academic performance in public and private secondary schools. Addressing this issue is particularly relevant as Nigeria pursues a decentralised, evidence-based approach to educational governance. A study reveals that guideline resolutions, accompanied by headship instructions in programs, encourage productivity that extends beyond several academic environments.

Research Objective

1. To examine the effect of headship method on teachers' impact in public and private secondary schools in Bayelsa State

Research Questions

1. Is there a relationship between leadership approaches and teacher performance in public and private schools in Bayelsa State?
2. Are there significant differences in the effects of leadership theories on teacher performance across school types?

Hypotheses

1. H_0 : There is no significant relationship between leadership approaches and teacher performance in public and private secondary schools.
2. H_1 : There is a significant difference in the effect of leadership approaches on teacher performance across school types.

Significance of the Study

This study is of great significance as it addresses the persistent and structural hierarchy or leadership constraints confronting the secondary school education system in Bayelsa State, Nigeria. Through the conduct of a study into the comparative impact of headship or leadership method, especially Max Weber's principle of bureaucracy, on educator productivity and effectiveness on the outcome of students in government and privately owned secondary schools. Thus, the research offers different gains and strategies. Guideline and implementation of all strategies. In conclusion, the investigation provides an opportunity for critical foresight not only for stakeholders in the educational industry in Bayelsa State, but also for broader national and regional cooperation, to transform school governance through effective leadership. The research suggests a strong desire for change, which involves transforming the educational system through

strategic planning, leadership, and management, aimed at achieving optimal performance, accountability, and results, with clear objectives.

Theoretical Framework

Max Weber's bureaucratic theory provides a robust and enduring framework for evaluating leadership efficiency and administrative effectiveness in educational institutions, as well as assessing headship effectiveness and managerial effectiveness in educational organisations. The growth of Max Weber in the 20th century was structured to explain the reasons for authority in institutions, to civilise and modernise bureaucratic principles. Although the implementation of Max Weber's principles spread across different segments, including education, institutional structure, and headship conduct, it is crucial to institutional productivity and performance (Weber, 1974; Peretomode, 2008). The principle is based on five cardinal principles: hierarchy of authority, career orientation, division of labour, formal rules and regulations. This means that these specific principles offer an essential understanding of the framework, structure, and leadership in all aspects of its operations and functions.

Division of Labour: This refers to the allocation of specific tasks to individuals based on expertise and job roles. For Bush (2015), the shared tasks of each individual centred on professional and work duties. In the context of educational leadership, clear responsibilities are allocated among teaching and non-academic staff to ensure effectiveness, productivity, and accountability. Under the division, job specifications are more clearly communicated, enabling teachers to function effectively in the discharge of their duties and achieve impactful educational results.

Hierarchy of Authority: Max Weber emphasised straightforward procedures for command and control in achieving tasks and monitoring progress, from top-level management (principals and department heads) to subordinate staff. This hierarchical arrangement promotes order, reinforces leadership legitimacy, and facilitates effective communication within the school system (Okorie, 2011).

Career Orientation: Bureaucratic institutions and organisations place importance on merit-based focus, recruitment, timely promotion, and career advancement. In educational organisations, this guideline enhances the advancement and progression of teachers and school heads in terms of qualifications, competence, capacity, and experience. While professional growth promotes motivation to institutional commitment (Amanchukwu, Stanle & Oologube, 2015)

Formal Rules and Regulations: For Eze & Agba (2023), the rule provides a framework for procedures and standards that facilitate valid judgment, performance rating, evaluation, and conflict resolution. The consistent application of Max Weber's theory promotes transparency, reliability, fairness, and consistency, while mitigating administrative injustice. Support for this approach encourages institutional integrity and ethics.

Impersonal Relationships: The theory of Max Weber serves as a more potent promoter of the goals of impartiality and fairness (Odukoya, 202). Weber advocated for objectivity, recognising that administrative issues of irregularities and deviations, alongside political distortion, frequently impact school efficiency. By applying Max Weber's principles, the investigation seeks to identify the fundamental conditions that influence leadership or headship outcomes and to discover new methods that may enhance the emerging educational design for school governance efficiency.

Leadership, Teacher Output, And the School Administration: Empirical Review

School headship and school management remain experimentally connected to the issues of teachers' performance, productivity, and learners' outcomes in several frameworks. That is evident

in diverse reviews of studies by Leithworth et al. (2004). That leadership is next to classroom instruction in impacting student knowledge gathering, as its elusive nature of work underlies the importance of teachers' tasks in ensuring the effectiveness of student outcomes in achievement. Thus, Lockheed (1989) posit that teacher standards play a significant role in student academic achievement, particularly when teachers possess subject-matter mastery and classroom management skills. Additionally, more recent evidence from Adeyemi (2020) has shown that teacher effectiveness in Civic Education significantly predicts student performance in Osun State, underscoring the importance of administrative supervision and professional development. A comparative analyses of public and private schools suggest that there are differential outcomes. For example, Adeyemi (2014) and Okologbon et al. (2020) observed higher student achievement in private schools, attributing this to smaller class sizes, stricter accountability, and closer supervision. However, they cautioned that socio-economic background and selective enrolment may confound these differences.

Ogiriki and Enemu (2017), in a Bayelsa-specific study conducted in Yenagoa Local Government Area, reported that principals' leadership styles significantly influenced teachers' job satisfaction, which in turn affected student outcomes. Additionally, Akpe and Owan (2023) found that transformational and transactional leadership practices in Bayelsa schools were positively correlated with teacher morale. More recently, Agi and Adiola (2025) emphasised moral leadership as a determinant of teacher professionalism, highlighting the ethical dimensions of administration in the state.

Overall, these studies confirm that effective leadership and administration are essential for enhancing the productivity of teachers and students. However, most Nigerian and Bayelsa-based studies rely on cross-sectional survey data, limiting causal inference. Future research should employ longitudinal and mixed-methods designs to capture the dynamics between leadership, administration, and educational outcomes more effectively.

Methodology

This study utilised a correlational survey design to examine the relationship between leadership approaches and the performance of teachers and students in public and private secondary schools in Bayelsa State. This design was suitable due to its objectivity. The target population comprised principals and teachers from selected secondary schools in Bayelsa State. Two schools were purposively selected as case studies based on ownership type: Community Comprehensive Secondary School (CCSS), Agbura (Public) and Belary School, Imiringi Road, Yenagoa (Private). A total of 80 participants (40 from each school) were randomly selected using a stratified random sampling technique to ensure proportional representation from both staff cadres (teachers and principals) and school types.

1. The Teachers and Students Academic Performance Questionnaire (TSAPQ) is a structured 4-point Likert-type instrument developed by the researcher based on prior literature.

The TSAPQ had two major sections:

- Section A: Demographics of respondents
- Section B: 20 leadership effectiveness statements rated as:
 - a. Strongly Agree = 4
 - b. Agree = 3
 - c. Disagree = 2
 - d. Strongly Disagree = 1

The criterion mean was computed as:

$4+3+2+1=2.5 \frac{4+3+2+1}{4} = 2.5$. Items with a cumulative mean ≥ 2.5 were considered significant.

Content validity was ensured through expert review from three educational researchers. The reliability of the questionnaire was assessed using Cronbach's Alpha, yielding a reliability coefficient of 0.84, which indicates high internal consistency. Data collection occurred over two weeks. All respondents were informed about the study's objective and provided informed consent. The completed instruments were collected on the same day to maximise the response rate. Descriptive statistics (mean, standard deviation, and rank order) were used to analyse the data, alongside inferential statistics (One-Way ANOVA) to test the stated hypotheses. Decision rules were based on the benchmark criterion mean score of 2.5.

Results**Research Question 1**

Is there a relationship between leadership approaches and the performance of public and private secondary school teachers in Bayelsa State?

Table 1 presents the mean responses of principals and teachers on key leadership indicators based on Weber's bureaucratic principles. The criterion mean was set at 2.50.

Indicator	Principals (Public)	Principals (Private)	Teachers (Public)	Teachers (Private)	Cumulative Mean	Above Criterion?
Impersonal relations improve leadership efficiency	2.53	2.68	2.61	2.73	2.64	Yes
Defined roles enhance productivity	2.74	2.73	2.74	2.89	2.78	Yes
Hierarchy of authority improves work ethics	3.18	2.67	2.93	2.63	2.85	Yes
Formal rules and procedures ensure target achievement	3.22	3.18	3.20	2.68	3.07	Yes

All indicators scored above the criterion mean, confirming that leadership approaches characterised by structure, rules, and clarity positively influence teacher performance in both public and private schools.

Research Question 2: What is the relationship between leadership effectiveness and the academic performance of teachers in public secondary schools?

Teachers in public schools reported high levels of agreement with key bureaucratic indicators. They affirmed that impersonal relationships, clearly defined job roles, a structured hierarchy, and formal rules contribute positively to their effectiveness.

Table 2: Mean Scores on Leadership Effectiveness in Public Schools

Indicator	Mean Score
Impersonal relations improve teacher efficiency	2.66
Defined roles enhance teacher productivity	2.81
Hierarchy of authority improves teacher work ethics	2.73
Formal rules ensure that targets are achieved	2.52

All responses from public school teachers scored above the criterion mean, indicating a strong relationship between bureaucratic leadership principles and improved academic performance.

Research Question 3

What is the relationship between leadership effectiveness and the academic performance of teachers in private secondary schools?

Private school respondents expressed even stronger agreement with bureaucratic leadership features. Emphasis was placed on adherence to formal rules and defined roles, both of which recorded high mean scores.

Table 3: Mean Scores on Leadership Effectiveness in Private Schools

Indicator	Mean Score
Impersonal relations improve teacher efficiency	2.77
Defined roles enhance teacher productivity	2.85
Hierarchy of authority improves teacher work ethics	2.94
Formal rules ensure that targets are achieved	3.04

All indicators exceeded the criterion mean of 2.50, suggesting that the structured, accountability-driven leadership style adopted by private schools significantly contributes to improved teacher performance and learning outcomes.

Hypothesis Testing

Hypothesis	Decision
H ₀ : No significant relationship between leadership approach and performance	Rejected
H ₁ : Significant difference in leadership impact between school types	Accepted

Analysis and Discussion of Findings

1. Leadership Approaches and Performance in Public and Private Schools

The data analysis revealed a significant relationship between theoretical approaches to leadership, particularly Max Weber's bureaucratic theory, and the performance of teachers in both public and private schools in Bayelsa State. Across all four key indicators (impersonal relations, defined roles, hierarchy of authority, and formal procedures), cumulative mean scores were above the criterion value of 2.50. The highest scoring indicator, "Formal rules and procedures ensure that

targets are achieved" (Mean = 3.07), was especially emphasised in private schools, suggesting a strong culture of policy adherence and administrative discipline.

The findings align with earlier research by Bush (2015), who posited that clearly defined organisational structures, such as bureaucratic authority and hierarchy, are instrumental in promoting effective school leadership. Peretomode (2008) similarly argued that the bureaucratic model enhances accountability and efficiency in educational systems, especially when roles are explicitly outlined. While public school principals and teachers also recognised the value of these structures, their relatively lower scores suggest weaker or inconsistent implementation of bureaucratic principles in public schools.

2. Impact of Leadership Effectiveness on Teacher Performance in Public Schools

The data indicate that leadership effectiveness has a significant influence on teacher performance in public schools, although the relationship appears to be more moderate than in private schools. For example, public school teachers acknowledged that impersonal relations (Mean = 2.66) and hierarchical authority (Mean = 2.73) enhanced their work ethics. However, observational evidence and administrative documentation revealed inconsistencies in the application of these leadership principles.

This aligns with findings by Efanga and Ifejiaga (2014), who reported that the organisational culture in many Nigerian public schools tolerates ineffective rule enforcement, political interference in leadership appointments, and minimal performance evaluation mechanisms. The weaker enforcement of impersonal orientation and accountability measures potentially undermines institutional effectiveness in public education.

3. Impact of Leadership Effectiveness on Teacher Performance in Private Schools

Private schools displayed the highest cumulative mean values across leadership indicators, suggesting stricter adherence to bureaucratic principles. For instance, "Hierarchy of authority improves work ethics" (Mean = 2.94) and "Formal rules ensure target achievement" (Mean = 3.04) received the highest scores among responses from private schools. This suggests that private schools are more efficient in operationalising Weberian bureaucratic structures, resulting in better teacher performance and possibly enhanced student outcomes. This is consistent with Okorie (2011) and Yusof & Ali (2022), who argue that private schools in Nigeria are generally better managed due to limited political interference, stricter enforcement of policies, and stronger internal accountability frameworks.

Theoretical Implications

The findings affirm the relevance and applicability of Max Weber's bureaucratic theory to modern school administration. All five core elements — division of labour, hierarchy of authority, rules and regulations, career orientation, and impersonal relationships — were shown to distinguish effective leadership practices, particularly in private school settings.

Additionally, the study supports Fiedler's Contingency Theory, which suggests that the effectiveness of a leadership style depends on the context in which it is applied. The data show that while bureaucratic structures benefit both public and private schools, their success is influenced by institutional culture, ownership, and Autonomy. Vroom and Yetton's (1973) decision-making model also aligns with the findings, as private school leaders, who have greater discretionary authority, make faster and more effective decisions than their public school counterparts.

Conclusion

This study concludes that Weberian bureaucratic structures, comprising defined hierarchy, formal rules and procedures, career orientation, division of labour, and impersonal relationships, significantly influence the leadership and administrative effectiveness of secondary schools in Bayelsa State. When properly implemented, these organisational elements enhance teacher performance and contribute positively to student academic outcomes. They provide a structural framework that promotes consistency, accountability, and professionalism in the management of educational institutions.

Notably, the study highlights an apparent dichotomy in the application of these principles between public and private schools. Private schools demonstrate more vigorous rule enforcement, more explicit role allocation, and greater administrative discipline, often insulated from political interference and operating with more decision-making autonomy. In contrast, public schools struggle with vague administrative structures, inconsistent supervision, and politicised appointments, all of which undermine leadership and teacher performance.

The findings reaffirm that bureaucratic models, when integrated into functional administrative systems, serve as powerful instruments for achieving institutional goals in education. The study underscores the need for public school reforms, particularly aligning leadership practices with proven organisational theories that enhance performance, accountability, and long-term development outcomes.

Recommendations

In light of the empirical findings and theoretical insights from this study, the following recommendations are proposed:

1. Institutionalise Bureaucratic Best Practices in Public Schools

- The Bayelsa State Ministry of Education should formally integrate Max Weber's bureaucratic principles into administrative protocols.
- Develop and distribute school leadership manuals that incorporate precise role specifications, procedural guidelines, and hierarchical structures.
- Establish Standard Operating Procedures (SOPs) for all administrative and academic activities.

2. Leadership Training and Capacity Development

- Organise periodic training workshops for principals and senior school administrators on bureaucratic leadership, strategic planning, and school governance. Training should include modules on:
 - Rule-based decision-making
 - Performance monitoring and evaluation
 - Leadership ethics and accountability
 - Managing diversity in educational settings

3. Decentralise Decision-Making to Enhance Autonomy

- Grant school heads more authority in staff deployment, financial management, and discipline, within defined policy boundaries.
- Match this Autonomy with stringent monitoring and auditing mechanisms.

4. Strengthen Supervision and Monitoring Systems

- Establish and equip internal supervision units in public schools.
- Introduce external evaluators to carry out unbiased assessments of leadership performance and compliance with bureaucratic standards.

5. Foster a Performance-Oriented Culture in Public Schools

- Introduce performance-based incentives for principals and teachers.
- Develop clear Key Performance Indicators (KPIs) tied to academic outcomes, teacher attendance, and administrative compliance.

6. Reduce Political Interference in School Leadership Appointments

- Establish a transparent, merit-based recruitment process for school leadership positions.
- Base appointments on educational qualifications, administrative experience, and leadership competencies.

7. Strengthen Record-Keeping and Documentation

- Enforce consistent use of written documentation in all school operations.
- Provide digital tools and training for managing attendance, lesson plans, staff evaluations, and student records.

8. Promote Collaboration Between Public and Private Schools

- Facilitate knowledge-sharing forums such as peer learning exchanges, workshops, and mentorship schemes.
- Encourage public schools to adopt best practices from private institutions.

9. Implement Institutional Reforms at the Ministry Level

- The Ministry of Education should revise its administrative policies to reflect contemporary leadership models.
- Conduct regular policy reviews to identify implementation gaps and refine operational frameworks.

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ARTIFICIAL INTELLIGENCE IN HIGHER EDUCATION FOR SELF-RELIANCE: A KEY IMPERATIVE FOR SUSTAINABLE DEVELOPMENT

¹Phillemon Hananiya (Ph.D) & ²Francis Olajire Awodoyin (Ph.D)

^{1&2}Department of Educational Foundation

Faculty of Education,

Modibbo Adama University, Yola. Adamawa State, Nigeria.

hananiyaphilemon@gmail.com

Abstract

The integration of Artificial Intelligence (AI) in higher education is rapidly transforming the landscape of learning, offering innovative solutions to challenges faced by educational institutions globally. This paper explores the role of AI in fostering self-reliance among students and institutions, positioning it as a critical enabler of sustainable development. AI's potential to personalize learning, enhance administrative efficiency, and provide data-driven insights is reshaping educational methodologies, allowing for a more adaptive and resource-efficient system. By enabling personalized learning pathways, AI supports students in achieving mastery at their own pace, thereby fostering independence and critical thinking skills essential for self-reliance. Moreover, AI-driven automation in administrative processes frees up resources for research and community development, aligning with sustainable development goals (SDGs). Institutions adopting AI tools can enhance the quality of education, bridge knowledge gaps, and contribute to a workforce capable of addressing complex global challenges. However, the successful integration of AI in higher education requires investment in infrastructure, training for educators, and policies to ensure ethical use. This paper emphasizes that leveraging AI for self-reliance in higher education is not only a strategic imperative but also a cornerstone for sustainable development, empowering future generations to thrive in a rapidly evolving world.

Keywords: Artificial Intelligence, Higher Education, Self-Reliance and Sustainable Development.

Introduction

The world is undergoing a technological revolution, and Artificial Intelligence (AI) is at the forefront of this transformation (Brynjolfsson & McAfee, 2017). In the realm of education, AI holds the potential to reimagine how institutions teach, manage resources, and prepare students for the future (Luckin et al., 2016). The need for a resilient and independent workforce has never been more critical in addressing contemporary global challenges such as climate change, unemployment, poverty, and inequality (UNESCO, 2021). Higher education, therefore, must adopt innovative approaches, and AI offers a pathway toward this transformation. This paper examines how AI can serve as a catalyst for self-reliance and sustainable development in higher education. Artificial Intelligence is reshaping pedagogical practices by introducing adaptive learning systems that respond to individual student needs in real time (Holmes et al., 2019).

These AI-powered platforms analyze learners' behaviors, strengths, and weaknesses to create customized content delivery. By doing so, they foster independent learning and critical thinking, key attributes of self-reliance. Students are no longer passive recipients of knowledge but active participants in a dynamic learning process. This transformation aligns with the global shift towards student-centered education and lifelong learning models, which are essential for building resilient

individuals and communities (Siemens, 2018). Through automation, AI offers transformative potential in automating administrative tasks such as admissions, grading, scheduling, and student support services (Zawacki-Richter et al., 2019).

This reduces the workload on academic staff and enhances operational efficiency. Freed from routine processes, educators can focus more on mentoring, research, and engagement with societal issues. Efficient institutions are better positioned to deliver quality education, manage resources sustainably, and contribute meaningfully to national development efforts (Popenici & Kerr, 2017). AI-driven analytics empower institutions with actionable insights by analyzing vast datasets on student performance, enrollment trends, and resource utilization (Baker & Inventado, 2014). These insights support informed decision-making, enabling institutions to develop policies and interventions tailored to specific needs. Predictive analytics, for example, can identify at-risk students and trigger early interventions to prevent dropouts.

This strategic use of data supports a culture of continuous improvement and accountability—hallmarks of institutions capable of adapting to and thriving in changing environments (Ifenthaler & Yau, 2020). AI also holds the potential to democratize access to quality education, especially in underserved or remote regions. With AI-powered educational technologies, learners can access resources, tutors, and support regardless of geographic limitations (Luckin et al., 2016). Voice recognition tools, automated translation, and accessibility features make education more inclusive for students with disabilities and language barriers. By bridging these gaps, AI contributes to equitable learning opportunities and reduces educational inequalities, directly supporting the attainment of the United Nations Sustainable Development Goals (UNESCO, 2021). While the benefits are substantial, ethical issues such as data privacy, algorithmic bias, and depersonalization must be addressed through responsible governance (Williamson & Eynon, 2020).

Conceptualizing Artificial Intelligence in Higher Education

Artificial Intelligence refers to the simulation of human intelligence in machines programmed to think, learn, and act autonomously (Russell & Norvig, 2020). In higher education, AI applications range from intelligent tutoring systems and automated grading to predictive analytics and AI-enabled administrative support. These tools can enhance pedagogical outcomes and institutional efficiency (Zawacki-Richter, Marín, Bond, & Gouverneur, 2019). The deployment of AI aligns with global educational objectives such as UNESCO's Education 2030 Agenda and the United Nations' Sustainable Development Goals (SDGs), particularly Goal 4: Quality Education (UNESCO, 2021).

One of the most transformative applications of AI in higher education lies in intelligent tutoring systems. These systems provide personalized instruction and feedback to students, adapting to individual learning styles and paces. Unlike traditional, one-size-fits-all classroom approaches, AI systems continuously assess a student's progress and adjust content delivery accordingly (Holmes, Bialik, & Fadel, 2019). This facilitates deeper learning, allows students to master concepts at their own speed, and fosters self-directed learning—an essential component of self-reliance in education (Luckin, Holmes, Griffiths, & Forcier, 2016).

AI-powered automated grading systems offer real-time feedback and streamline assessment processes. These tools reduce the administrative burden on educators while ensuring consistency and fairness in evaluation (Baker & Inventado, 2014). Moreover, instant feedback helps students identify their strengths and areas for improvement without waiting for instructor input. This timely response mechanism supports formative assessment practices and enhances students' capacity to

take charge of their learning journeys, reinforcing autonomy and motivation (Popenici & Kerr, 2017).

Predictive analytics, powered by AI algorithms, analyze historical and real-time student data to forecast academic performance, engagement levels, and risk of dropout. This insight allows institutions to intervene early with academic support, mentorship, or counseling (Ifenthaler & Yau, 2020). By proactively supporting students before they face academic failure, universities can promote persistence, graduation, and ultimately, long-term self-reliance. Additionally, data-driven decision-making helps institutions better allocate resources to meet students' evolving needs (Siemens, 2018).

AI tools are also redefining academic advising and career planning. Chatbots and virtual advisors provide students with 24/7 guidance on course selection, degree requirements, and career pathways. These systems can analyze labor market trends and align academic programs with industry needs, preparing students for relevant and sustainable careers (Popenici & Kerr, 2017). Through AI-enabled planning tools, students become more proactive in shaping their educational and professional trajectories—further reinforcing the ideals of independence and purpose-driven education (Holmes et al., 2019).

AI contributes significantly to inclusivity in higher education. Machine learning models and natural language processing facilitate real-time language translation, transcription, and text-to-speech functionalities, supporting students with disabilities and those from diverse linguistic backgrounds (Luckin et al., 2016). Adaptive learning technologies ensure that no learner is left behind by customizing educational content to suit individual abilities and contexts. These inclusive innovations reflect the equity-driven vision of SDG 4 and contribute to a more resilient and empowered global academic community (UNESCO, 2021).

AI and the Promotion of Self-Reliance

AI enhances self-reliance in higher education through the following avenues:

Personalized Learning

AI-powered platforms are revolutionizing the traditional educational paradigm by enabling personalized learning experiences (Holmes, Bialik, & Fadel, 2019). Unlike conventional instruction, which often applies a uniform approach to diverse learners, AI systems leverage real-time performance data to adapt content delivery, pacing, and complexity to suit each student's unique learning profile (Luckin, Holmes, Griffiths, & Forcier, 2016). These platforms can identify areas where a learner excels or struggles and adjust accordingly, ensuring that instruction remains relevant and impactful. This data-driven customization transforms education from a passive experience into an active, student-centered journey (Siemens, 2018).

A fundamental advantage of AI-enabled instruction is the flexibility it affords learners to proceed at their own pace. Students no longer feel pressured to keep up with the average classroom pace or risk falling behind (Holmes et al., 2019). Instead, they can revisit challenging concepts, access additional resources, and progress only when they are confident in their understanding. This freedom allows students to construct deeper knowledge foundations and retain information more effectively, aligning with the principles of mastery-based learning—a key aspect of developing cognitive autonomy (Baker & Inventado, 2014).

As learners gain control over their educational experiences, their self-confidence grows. Being able to track their progress, witness measurable improvement, and overcome academic obstacles

independently fosters a sense of accomplishment and agency. This increased self-efficacy is vital not only for academic success but also for personal development. AI, by supporting incremental progress and goal-setting, encourages learners to take ownership of their education, which is essential in cultivating lifelong learning habits and resilience (Popenici & Kerr, 2017).

AI's personalized support structure significantly reduces students' dependency on constant instructor intervention. While teachers remain central to guiding and mentoring, AI tools supplement the learning process by offering on-demand assistance, feedback, and clarification (Ifenthaler & Yau, 2020). This balance between human instruction and machine assistance empowers learners to explore, inquire, and resolve academic challenges independently. The resulting self-reliance prepares students for real-world scenarios where critical thinking, problem-solving, and autonomous decision-making are indispensable (Williamson & Eynon, 2020).

The autonomy cultivated through AI-enabled learning transcends the classroom. As students become accustomed to managing their learning processes, they are better prepared for the demands of the modern workforce and society. Self-regulated learners are more adaptable, capable of upskilling in response to technological changes and economic shifts (Siemens, 2018). This capacity is essential in advancing the goals of sustainable development, particularly in building a workforce equipped to meet the evolving challenges of the 21st century. In this context, AI does not merely enhance academic outcomes—it nurtures a culture of continuous, self-directed growth (UNESCO, 2021).

Skill Acquisition and Decision-Making

AI-driven educational platforms have introduced advanced simulation tools that replicate real-world scenarios across various disciplines (Dede, 2009). Whether in healthcare, engineering, business, or the social sciences, these simulations allow students to engage in practical problem-solving within safe, controlled virtual environments. By mimicking the complexities of real-life contexts, AI simulations encourage learners to test theories, assess consequences, and make data-informed decisions—an experience that deepens conceptual understanding and bridges the gap between theoretical instruction and applied knowledge (Dede, 2014).

The dynamic nature of AI simulations requires students to think critically, analyze multifaceted problems, and make strategic decisions under simulated pressure. Unlike traditional rote learning, these experiences demand active engagement and iterative learning, reinforcing cognitive processes such as synthesis, evaluation, and logical reasoning (Aldrich, 2005). As learners experiment with different approaches and receive real-time feedback, they build confidence in their judgment and develop the mental agility needed for addressing unpredictable, real-life challenges (Gee, 2013).

Beyond professional readiness, AI-powered simulations are powerful tools for cultivating entrepreneurial thinking. Students can model business plans, test market scenarios, simulate economic fluctuations, or engage in virtual startup competitions using AI platforms. This experiential learning fosters creativity, resilience, and a risk-tolerant mindset (Neck & Corbett, 2018). As such, AI not only prepares students for employment but also equips them with the competencies required to become job creators and innovators—key drivers of sustainable development and national self-reliance (Fayolle & Gailly, 2015).

Immersive learning environments, supported by AI and virtual reality (VR), enhance student motivation and retention. Learners are more likely to engage deeply with content when they can

see its practical relevance and experience it interactively (Slater & Sanchez-Vives, 2016). These emotionally engaging scenarios provide a sense of purpose and relevance, which is often lacking in conventional learning settings. Increased immersion leads to improved long-term retention of knowledge, better academic outcomes, and stronger learner autonomy (Makransky & Lilleholt, 2018).

Today's global job market is characterized by rapid technological change and the need for adaptive skill sets. AI-powered experiential learning prepares students for this volatility by equipping them with transferable competencies such as collaboration, adaptability, systems thinking, and technological fluency (Knickrehm, Berthon, & Daugherty, 2018). Through virtual internships, AI-driven case studies, and real-time decision-making exercises, students become future-ready—capable of thriving in multidisciplinary, digital-first work environments and contributing to sustainable economic ecosystems (World Economic Forum, 2020).

Resource Optimization

Artificial Intelligence has introduced a new level of operational efficiency in higher education institutions by automating time-consuming administrative tasks. Activities such as student enrollment, course registration, scheduling, and grading are now being handled with remarkable speed and accuracy through AI-powered systems (Zawacki-Richter et al., 2019). These innovations reduce bureaucratic bottlenecks, minimize human error, and ensure timely service delivery. As a result, administrative processes become more streamlined, enabling institutions to operate with greater agility and responsiveness to student needs (Popenici & Kerr, 2017).

By automating routine academic functions, AI allows educators and administrative personnel to redirect their energy toward more intellectually demanding and impactful roles. Faculty members, for instance, can invest more time in curriculum development, individualized mentoring, and scholarly research. Similarly, support staff can focus on strategic planning, policy development, and institutional advancement efforts. This reallocation of human capital strengthens the institution's capacity for innovation and excellence, fostering a culture of purposeful engagement and continuous improvement (Holmes, Bialik, & Fadel, 2019).

Freed from repetitive administrative burdens, instructors are better positioned to provide mentorship that goes beyond academic instruction. They can engage in personalized guidance, helping students navigate academic challenges, career planning, and emotional well-being. This shift humanizes the educational experience and supports a holistic model of student development, where learners are empowered to grow intellectually, socially, and ethically. The presence of AI does not replace human interaction but rather creates the space for deeper, more meaningful educational relationships (Luckin et al., 2016).

The time and resources saved through AI automation can also be channeled into community-based initiatives and research that address pressing societal needs. Higher education institutions, particularly in the Global South, often serve as engines of community development. With AI handling backend operations, faculty and students can actively participate in outreach programs, public education campaigns, and applied research projects that contribute to local development goals (Williamson & Eynon, 2020). This outward focus reinforces the university's role as a socially responsive and autonomous institution (UNESCO, 2021).

Ultimately, the adoption of AI strengthens institutional autonomy by enabling more strategic and efficient use of resources. With reduced reliance on manual labor for administrative tasks,

universities gain the flexibility to allocate funds and personnel toward long-term developmental goals. This includes investment in digital infrastructure, interdisciplinary research, and capacity-building initiatives. As institutions become more self-reliant, they are better equipped to adapt to changing educational landscapes, maintain quality standards, and contribute meaningfully to national and global development priorities (Siemens, 2018).

Aligning AI with Sustainable Development Goals (SDGs)

The integration of AI into higher education contributes to multiple SDGs:

Goal 4 (Quality Education): Enhances access, equity, and learning outcomes.

Goal 8 (Decent Work and Economic Growth): Prepares students with skills relevant for the digital economy.

Goal 9 (Industry, Innovation, and Infrastructure): Encourages technological innovation in learning environments.

Goal 10 (Reduced Inequality): AI can bridge educational gaps by reaching underserved populations through adaptive learning tools.

AI thus plays a transformative role in building a resilient and self-sustaining educational ecosystem.

Challenges to AI Integration in Higher Education

Despite its promises, the integration of AI faces several constraints:

Infrastructural Deficit: One of the most significant barriers to AI integration in higher education, particularly in developing countries, is the lack of adequate technological infrastructure. Many institutions struggle with limited internet connectivity, outdated hardware, unreliable power supply, and insufficient digital platforms to support AI-driven learning environments. These infrastructural weaknesses inhibit the seamless deployment of intelligent systems and compromise the scalability of AI solutions. Without a solid technological foundation, even the most promising AI initiatives are likely to fail. Bridging this infrastructural gap is critical for enabling equitable access to AI-enhanced education and ensuring that institutions can fully leverage the benefits of emerging technologies.

Capacity Gaps Even: where infrastructure exists, a substantial capacity gap hinders the effective use of AI in higher education. Educators, administrators, and support staff often lack the technical expertise required to implement, manage, and integrate AI tools into teaching and administrative functions. This gap includes limited digital literacy, unfamiliarity with AI principles, and a general lack of training in data interpretation and adaptive learning technologies. Furthermore, there is a shortage of AI-focused curricula in teacher training programs, leaving many professionals underprepared. Closing this capacity gap necessitates continuous professional development, curriculum reform, and collaborative learning opportunities to build institutional competence in AI utilization.

Ethical and Privacy Concerns: The widespread use of AI in education raises pressing ethical and privacy issues, particularly regarding the collection and analysis of student data. AI systems often rely on large datasets to function effectively, which means personal information—such as learning behaviour, assessment performance, and even biometric data—can be collected, stored, and analyzed. Without clear and enforceable data governance policies, there is a risk of misuse, surveillance, or breaches of confidentiality. Moreover, AI systems can inherit biases from training data, leading to discriminatory outcomes. Ensuring ethical AI deployment requires robust

frameworks for data protection, transparency in algorithm design, and inclusive policies that safeguard student rights and promote equity.

Financial Constraints: Another major challenge to AI integration in higher education is the high cost associated with acquiring, implementing, and maintaining AI technologies. From procuring software licenses and cloud services to hiring data scientists and upgrading IT infrastructure, the financial burden can be overwhelming—especially for underfunded institutions in low- and middle-income countries. The lack of stable funding streams further limits the ability of these institutions to experiment with AI initiatives or to scale up successful pilots. Without strategic public investment, international support, or public-private partnerships, the adoption of AI in many educational settings may remain out of reach, thereby widening the digital divide.

Need for Strategic Investment and Collaboration: Addressing the multifaceted barriers to AI integration requires a coordinated and strategic approach involving all educational stakeholders. Governments must prioritize digital transformation in education by allocating dedicated funding, developing enabling policies, and supporting national research in AI and education. Similarly, institutions should invest in capacity building and infrastructure, while forming partnerships with technology firms, NGOs, and international organizations to share expertise and resources. Long-term sustainability will depend not only on funding and technology but also on fostering an institutional culture that embraces innovation, ethical use of technology, and inclusivity in digital learning strategies.

Recommendations

For AI to be effectively harnessed, the following steps are recommended:

Infrastructure Development: Governments and private sectors must invest in broadband connectivity, computing equipment, and AI platforms.

Capacity Building: Continuous professional development programs for educators and ICT staff should be institutionalized.

Policy Frameworks: Clear regulatory guidelines must be established to ensure ethical and inclusive use of AI in education.

Public-Private Partnerships: Collaboration with tech firms can accelerate AI adoption and innovation.

Inclusive Design: AI systems should be designed to accommodate diverse learners, including those with disabilities.

Conclusion

Artificial Intelligence has the potential to revolutionize higher education by fostering self-reliance among students and institutions. Through personalized learning, automation, and data-driven decision-making, AI enhances educational quality and efficiency. Its alignment with sustainable development goals further underscores its relevance in contemporary education reform. However, its successful integration depends on addressing infrastructural, financial, and ethical challenges. Investing in AI is investing in the future a future where higher education becomes a launchpad for self-reliance, innovation, and sustainable development.

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ICT ADOPTION PRACTICES AND SUSTAINABILITY OF PRIVATE SECONDARY SCHOOLS IN CROSS RIVER STATE, NIGERIA

¹Ayang, John Etura Ph.D, ²Ibe Odum Ibe Ph.D,
³Effiom, Eme Inyang & ⁴Mary Bassey Okwa Ph.D

¹University of Education and Entrepreneurship
Akamkpa, Calabar

^{3&4}Department of Educational Management
University of Calabar
eturajohn@gmail.com

Abstract

This study examined 1CT adoption practices and sustainability of private secondary schools in Cross River State, Nigeria. The research design adopted for the study was survey research design. One research question and one research hypothesis were formulated to guide the study. Purposive sampling technique was used to sample 105 private secondary school proprietors in 2019/2020 academic year in Calabar Education Zone. The instrument used for the study was 24 items modified 4-point Likert-type questionnaire called ICT Adoption Practices and Sustainability of Private Secondary Schools Questionnaire (APSPSSO). The reliability estimate of the instrument was established through the Cronbach Co-efficient Alpha Reliability methods. Data were using One-way analysis of variance (ANOVA). The major finding of the study revealed that ICT adoption practices has a significance influence on sustainability of private secondary schools in terms of learning environment, effective teaching and Curriculum content. Based on the finding, it was recommended among others that in- service training should be conducted regularly by private school proprietors to acquaint teachers with recent innovations in management and 1CT facilities available for teaching analysed and learning.

Keywords: ICT Adoption, Sustainability and Private Schools

Introduction

Information Communication Technologies (1CTs) are information handling tools that are used to produce, store, and process, distribute and exchange information. These different tools are now able to work together, and combine to form networked world which reaches into every corner of the globe. It is an increasingly powerful tool for participating in global markets, promoting political accountability; improving the delivery of basic services; and enhancing local development opportunities (Toyo, 2017). ICT “is an electronic based system of information transmission, reception, processing and retrieval, which has drastically changed the way we think, the way we live and the environment in which we live”. It can be used to access global knowledge and communication with other people (Ogunsola, 2005).

Information and communication technologies (ICTs) are electronic technologies used for information storage and retrieval. Development is partly determined by the ability to establish a synergistic interaction between technological innovation and human values. The rapid rate at which 1CTs have evolved since the mid-20th century, the convergence and pervasiveness of ICTs, give them a strong role in development and globalization. ICTs have a significant impact on all areas of human activity (Hassan & Ogundipe, 2017).

The field of education has been affected by ICTs, which have undoubtedly affected teaching, learning, and research. A great deal of research has proven the benefits to the quality of education. ICTs have the potential to accelerate, enrich, and deepen skills, to motivate and engage students. to help relate school experience to work practices, create economic viability for tomorrow's workforce., as well as strengthening teaching and helping schools change (Yusuf. 2005). In a rapidly changing world, basic education is essential for an individual to be able to access and apply information. Such ability must include ICTs in the global village. The Economic Commission for Africa has indicated that the ability to access and use information is no longer a luxury. but a necessity for development. Unfortunately, many developing countries, especially in Africa, are still low in ICT application and use (Adigun & Akinbinu, 2017).

Ownership of educational institutions in Nigeria is between the public and private sectors. The public sector here refers to government at the three tiers (Federal, State and Local Government). While the private sector refers to an individual, or group of persons, organizations or mission bodies coming together to establish and run an educational institution at any level of the educational system namely, nursery, primary, secondary, and or colleges of education, polytechnics and universities among others. Schools that are established and run by governments are called public schools while those established by individuals, organizations and mission bodies are referred to as private schools. Consequently, according to Omotoso (2008) private schools are those schools that have the following characteristics:

- i. Supported by private organization or individuals rather than by the state
- ii. Independent schools that are supported wholly by the payment of fees
- iii. Schools that are not administered by local, state or federal governments
- iv. They are schools that retain the right to select their students
- v. They are schools that do not rely on mandatory taxation through public or government funding.

According to Ayeni (2008) the continuity or sustainability of private school entails Continuous adoption of ICT practices, constant school enrolment, maintenance of school plants, maintenance of staff and effective teaching etc. As any obstruction in this area can mean that the school is gradually coming to a closure or breakdown. However, private schools are constantly Confronted with the problem of sustainability in terms of learning environment, effective teaching and curriculum content.

Sustainability on the other hand is the continuous existence of a firm or business as stated by Olumide (2014). The sustainability of private secondary school is very important as it makes meaningful contributions to the growth of the Nigerian economy, and the continuous existence of private secondary schools help to ensure continuous partnership with the public and private in the provision of qualitative education to all citizens.

Learning environment refer to the environment, facilities as well as the arrangement of such facilities within the school environment (Adekunle, 2012). School facilities decay from time to time due to the destructive nature of students and lack of maintenance culture by proprietors in Cross River State. Failure to replace or maintain such facilities will mean the extinction of learning facilities for students in the near future. The school environment of private secondary schools also needs to be constantly improved, as the environment can grow old and decay over time, without constant maintenance. When this happens, parents will begin to withdraw their wards because no parent wants their children to remain in a school without conducive learning environment.

Effective teaching refers to the ability of the school to cover both academic and non-academic aspects of the curriculum with evidence seen in the change of attitude of the students who attend the school. This aspect of school sustainability is relevant because parents will not want to spend money on their children without getting what they are spending money for as every parent expects that the school should be very effective in teaching as that is what they are paying for. Parents will therefore gradually remove their children from the school if they find out that the school is not thorough enough in their teaching, thereby leading to the closure of such schools.

Curriculum content implementation is very important in the sustainability and continuity of private secondary schools in Cross River State because, for a school to continue to exist such school must be able to achieve the purpose of existence which is basically embedded in its curriculum. The curriculum contains detailed information about everything that is expected to be taught in the school including extra-curricular activities. The school is therefore expected to cover everything that is written or documented in the school curriculum. However, for curriculum implementation to be very effective there has to be effective communication and ICT adoption practices.

The need for ICT in Cross River State private secondary schools cannot be overemphasized, in this technology-driven age, everyone requires ICT competence to survive. Organizations are government to provide basic facilities including ICT-driven teaching aids for the nation's educational system (Tob-ogu, Kumar & Cullen 2018). Thomas (2007), posited that ICT innovations and skills can contribute significantly to the effective management and sustainability of private secondary schools in Nigeria. He noted that it is not uncommon to find that many establishments in Nigeria, including educational institutions, still keep records in files and tucked them away in filling cabinets where they accumulate dust. Many of these files are often eaten up by rodents and cockroaches thus rendering them irretrievable. A great deal of routine administrative work in government establishment is still done manually with the state and the Federal government showing little or no interest in embracing ICT. The official administrative drudgery in government offices and education institutions can be better managed through ICT. Educational administrative functions include a wide variety of activities such as 'educational governance, supervision, support services, infrastructure, finance, budgeting, accounting, personnel selection and training system monitoring and evaluation, facilities procurement and management, equipment maintenance, research, and so on.

In most Nigerian schools, officials still go through the laborious exercise of manually registering students, maintaining records of pupil performance, keeping inventory list of supplies, doing cost accounting, paying bills, printing reports and drawing architectural designs. The huge man-hour spend on these exercises can be drastically reduced with ICT to enhance overall management procedure. Thomas (2007) averred that "Computer bring great speed and accuracy to each of these tasks, along with the convenience of storing large quantities of information on 'small disks or tapes. The prevailing condition in school management in Nigeria is disheartening and discouraging. The country seems to be living in prehistoric times in the educational management while even developing countries in Africa such as South Africa, Kenya, Uganda and Tanzania are far ahead of Nigeria in ICT applications. Despite its huge material resources and population endowment, Nigeria cannot be counted among progressive nations Using ICT in educational management, as technology has become a critical tool for achieving success in education.

Generally, adoption of ICT is in different phases, some are in the embryonic stage while some schools have successfully incorporated ICT into their curriculum for both privately or publicly funded secondary schools in Nigeria. A survey on ICT adoption on education in Nigeria showed that most research is on the tertiary education and very little on secondary education. The adoption

and use of ICT in private secondary schools have a positive impact on teaching, learning, and research and enrolment (Opeyemi, Sheila, Hilary, Peter & Anuoluwapo, 2016). Despite the roles ICT play in education, secondary schools in Cross River State and Nigeria as a whole are yet to extensively adopt them for teaching and learning. Efforts geared towards integration of ICT into the secondary school system, have not had much impact. Problems such as poor policy and project implementation strategies and poor information infrastructure militate against these efforts. (Eyong, 2017).

While the problem of lack of sustainability of private secondary schools greatly depends on learning environment, effectiveness of teaching and curriculum implementation, these variables are further influenced by ICT practices adopted by private schools. This ugly situation has led to closure of many private secondary schools in Cross River State, as it is observed that some of the private secondary schools established in the State are closed down after few years of its existence and this closure is sometimes as a result of poor learning environment, ineffective teaching, and poor curriculum implementation. The problem of the study is therefore posed. How does ICT adoption practices influence sustainability of private secondary schools in Calabar Education Zone in terms of learning environment, effective teaching and curriculum content?

Method

The research design adopted in conducting this study was the survey research design. Purposive sampling technique was used to sample 105 private secondary school proprietors in 2019/2020 school session in Calabar Education 'Zone of Cross River State, Nigeria. Data were collected through a 24 Likert-type questionnaire called ICT Adoption Practices and Sustainability of Private Secondary Schools Questionnaire (IAPSPSSQ). The questionnaire was divided into three sections (A, B and C). Section A collected demographic information such as Name of School, Sex, Age, Proprietor's working experience etc. while section B elicited information on ICT adoption practices which consisted six items and section C was on the three components of sustainability of private secondary schools, namely: Learning environment. Effective teaching and Curriculum. Six items were generated for each of the components, which amounted to 18 items. The items were presented in form of statements and presented in form of questions for school Proprietors to indicate their level of articulation. The extent of these articulations ranged from Strongly Agree (4-points), Agree (3-points), Disagree (2-points) and Strongly Disagree (1-point). Thus, it was made up of modified four points likert scale. The items were tested for internal consistency and Cronbach Alpha Coefficient of 0.89 was obtained and accepted as showing acceptable level of consistency.

Results

The results derived are presented in this section. Answers are also provided to research question. HO: There is no significant influence of ICT adoption practices on sustainability of private secondary schools in terms of learning environment, effective teaching and curriculum content.

The independent variable in the hypothesis is ICT adoption practices categorized as (Low, Moderate and High) while the dependent variable is sustainability of private secondary schools with its three dimensions (learning environment, effective teaching and curriculum content). One-way Analysis of Variance (ANOVA) was employed to test the hypothesis. The result of the analysis is presented in table 1.

The upper part of the table showed the mean and standard deviation of the variables in the hypothesis, while the lower part of the table showed the actual ANOVA table results. These results showed the calculated F-value of 6.36, 9.31, 4.93 and 8.42 for learning environment, effective

teaching, curriculum content and overall sustainability respectively and the critical F-value of 3.09 at .05 level of significance with 2 and 102 degrees of freedom. From the analysis, the calculated F-value for learning environment, effective teaching, curriculum content and overall sustainability are respectively higher than the critical F-value. Based on this, the null hypothesis which states that there is no significant influence of ICT adoption practices on sustainability of private secondary schools in terms of learning environment, effective teaching and curriculum content was rejected. These results imply that there is a significant influence of ICT adoption practices on sustainability of private secondary schools in terms of learning environment, effective teaching and curriculum. Because the F-values were significant, the Bonferroni post hoc test was conducted to determine the direction of the significance and the result is presented in table 2.

With respect learning environment, the post hoc result in table 2 using the significant two-tail and the mean difference significant at .05, revealed that there was significant difference between private secondary schools with low ICT adoption practices and those with moderate ICT adoption practices (-3.238*, .001). There was no significant difference between private secondary schools with moderate ICT adoption and those with high ICT adoption practices, there was and significance difference between private secondary schools with high ICT adoption practices and those with low ICT adoption practices.

In the aspect of effective teaching, the post hoc results in table 2 revealed that there was significant difference between private secondary schools with low ICT adoption practices and those with moderate ICT adoption practices (-2.648*, .000), significant between low and high ICT adoption practices (-2.411*, .000), which is the same relationship between moderate and low ICT adoption practices, high and low ICT adoption practices respectively. Finally, there was no significance difference between private secondary schools with moderate and high ICT adoption practices.

As regard curriculum content, the post hoc results in table 2 revealed that there was significant difference between private secondary schools with moderate ICT adoption practices and private secondary schools with high ICT adoption practices (-1.773 *, .010). Which is the sane relationship between private secondary schools with ICT adoption practices and moderate ICT adoption practices. And finally, there was no significant difference between private secondary schools with low ICT adoption practices and those with moderate and high ICT adoption practices in terms of curriculum content.

On overall sustainability, the post hoc results in table 2 revealed that there was a significant difference between private secondary schools with low ICT adoption practices and those with moderate ICT adoption practices (-5.688*, .000), significant between low and high ICT adoption practices (-5.188*, .001), which is the same relationship between moderate and low ICT adoption practices, high and low ICT adoption practices respectively. Finally, there was no significance difference between private secondary schools with moderate and high ICT adoption practice.

Table 1: Summary of One-Way Analysis of Variance (ANOVA) of the influence of ICT adoption practices on sustainability of private secondary schools

Sub variables	Group	ICT adoption practices	N	Mean	SD	
Learning Environment	Total	Low	29	16.55	4.06	
		Moderate	38	19.79	3.74	
		High	38	18.16	3.54	
			105	18.30	3.89	
Effective Teaching	Total	Low	29	16.93	3.45	
		Moderate	38	19.58	1.77	
		High	38	19.34	2.74	
			105	18.76	2.90	
Curriculum Content	Total	Low	29	18.82	2.83	
		Moderate	38	17.87	4.44	
		High	38	18.73	3.54	
			105	18.30	3.88	
Overall Sustainability	Total	Low	29	51.21	6.32	
		Moderate	38	56.89	5.94	
		High	38	56.39	6.07	
			105	55.14	6.51	
Sub variables	Source of variation	SS	Df	MS	F	Sig.
Learning Environment	Between Groups	173.71	2	86.85	6.36*	.002
	Within Groups	1392.54	102	13.65		
	Total	1566.24	104			
Effective Teaching	Between Groups	135.37	2	67.69	9.31*	.000
	Within Groups	741.68	102	7.27		
	Total	877.05	104			
Curriculum Content	Between Groups	77.35	2	38.69	4.93*	.009
	Within Groups	799.66	102	7.84		
	Total	877.05	104			
Overall Sustainability	Between Groups	625.44	2	312.70	8.42*	.000
	Within Groups	3787.42	102	37.132		
	Total	4412.88	104			

*P<.05, Critical Value $F_{2,102} = 3.09$

Table 2: Bonferroni post hoc test of the influence of ICT adoption practices on sustainability of private secondary schools in terms of learning environment, effective teaching, curriculum content and overall sustainability

Variables	ICT adoption practices (I)	ICT adoption practices (J)	I-J	Std. Error	Sig
Learning environment	Low adoption practices	Moderate ICT adoption practices	3.238*	.911	.001
		High ICT adoption practices	-1.606	.911	.081
		Low ICT adoption practices	3.238*	.911	.001
	Moderate adoption practices	High ICT adoption practices	1.632	.848	.057
		Low ICT adoption practices	1.606	.911	.081
Effective teaching	High adoption practices	Moderate ICT adoption practices	-1.632	.848	.057
	Low adoption practices	Moderate ICT adoption practices	-2.648*	.655	.000
		High ICT adoption practices	-2.411*	.655	.000
		Low ICT adoption practices	2.648*	.655	.000
	Moderate adoption practices	High ICT adoption practices	.237	.619	.073
		Low ICT adoption practices	2.411*	.655	.000
	High adoption practices	Moderate ICT adoption practices	-.237	.619	.073
Curriculum content	Low adoption practices	Moderate ICT adoption practices	1.691	.975	.257
		High ICT adoption practices	-.042	.973	1.000
		Low ICT adoption practices	-1.691	.975	.257
	Moderate adoption practices	High ICT adoption practices	-1.73*	.575	.010

			Low ICT adoption practices	.042	.973	1.000
	High adoption practices	ICT	Moderate adoption practices	1.733*	.575	.010
Overall Sustainability			Moderate adoption practices	- 5.688*	1.503	.000
	Low adoption practices	ICT	High ICT adoption practices	- 5.188*	1.503	.001
			Low ICT adoption practices	5.688	1.503	.000
	Moderate adoption practices	ICT	High ICT adoption practices	.500	1.398	.721
			Low ICT adoption practices	5.180	1.503	.001
	High adoption practices	ICT	Moderate adoption practices	-500	1.398	.721

* The mean difference is significant at the .05 level.

Discussion of Findings

The findings as revealed in the one-Way analysis of variance (ANOVA), shows that there was a significant influence of ICT adoption practices on sustainability of private secondary schools in terms of learning environment. effective teaching and curriculum content. As such, it's not possible for private secondary schools to stand the competitive nature of today academic world without the effective involvement and use of ICT skills and strategies in her educational System. On the other hand, the demand for computer/ICT literacy is increasing in Nigeria because employees have realized that computers and other ICT facilities can enhance efficiency. Similarly, employees have also realized that computers can be a threat to their jobs, and the only way to enhance job security is to become computer literate. With the high demand for computer literacy, the teaching and learning of these skills is a serious concern among professionals. This is also true of other ICT components. According to Aginam (2006), the importance of ICT adoption practices also prompted the Federal Government of Nigeria to launch the use of ICT in secondary schools and this makes it difficult for private secondary schools to enjoy the usual patronage without efficiently having ICT facilities and skills.

The result of the findings is in agreement with Eyong (2017) who found out that there was no significant difference in the mean rating of teachers and proprietors on the effect of ICT skills in the sustainability of private secondary schools. According to the author, new instructional techniques that use ICTs provide a different modality of instruments. For the student, ICT use allows for increased individualization of learning. In schools where new technologies are used, students have access to tools that adjust to their attention span and provide valuable and immediate feedback for literacy enhancement, which is currently not fully implemented in the Nigerian school system. ICT application and use will prove beneficial in improving Nigeria's educational system and giving students a better education. A technologically-advanced workforce will lead to

ICT growth in Nigeria, with the potential to improve military technology and telecommunications, media communications, and skilled ICT professionals who will be well-equipped to solve ICT problems in Nigeria and other parts of the world.

Conclusion

Based on the results of the study, it was concluded that ICT adoption practices significantly influence sustainability of private secondary schools in terms of learning environment, effective teaching and curriculum content. As such, private schools in Cross River in particular and Nigeria at large cannot afford to continually lag behind other countries in areas of ICT and computer usage. The continuous and conscious adoption of ICT in Nigeria will help to properly prepare the students for entrepreneurship and employment, thereby reducing unemployment and fast track the nation's quest to achieve Millennium Sustainable Goals.

Recommendations

On the basis of the findings of the study, the following recommendations were made:

1. In-service training should be conducted regularly by private school administrators to acquaint teachers with recent innovations in management and ICT facilities available for teaching and learning.
2. Private schools should set standard for teachers and other personnel employed into the school system.
3. Series effort should be put in place by private secondary schools to provide adequate ICTs facilities to boost information technologies in the state.

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INTEGRATING ARTIFICIAL INTELLIGENCE IN EDUCATIONAL MANAGEMENT: A CATALYST FOR SUSTAINABLE DEVELOPMENT IN AFRICAN INSTITUTIONS

Ajidele Ajoke Oluwafisayo¹ & Prof. Ileuma Senimetu²

^{1&2}Department of Educational Management,
Faculty of Education
Lead City University, Ibadan
fisayoajidele@gmail.com

Abstract

The swift advancement of digital technologies, especially Artificial Intelligence (AI), is transforming education systems worldwide by improving efficiency, personalising learning experiences, and facilitating evidence-based decision-making. Many African educational institutions encounter challenges concerning infrastructure, policy deficiencies, and human capacity that impede comprehensive AI integration. This paper examines the significant impact of AI on enhancing educational management and furthering the Sustainable Development Goals (SDGs), with a specific focus on SDG 4, which advocates for inclusive and equitable quality education. This paper presents recent empirical evidence and policy reports that underscore the transformative advantages of AI in automating administrative tasks, optimising resource allocation, enhancing data accessibility, and promoting personalised learning. This analysis critically evaluates the obstacles to AI adoption, such as digital inequality, ethical issues, institutional preparedness, and stakeholder resistance. The paper concludes with policy recommendations designed to foster responsible, inclusive, and context-sensitive integration of AI. The paper argues that Artificial Intelligence, when utilised effectively, can act as a significant catalyst for developing resilient, equitable, and future-ready education systems throughout Africa.

Keywords: Artificial Intelligence, Educational Management, Sustainable Development, African Institutions, Digital Transformation.

Introduction

The digital revolution has profoundly altered the global educational landscape, creating unparalleled opportunities to improve teaching, learning, and administration. Emerging technologies, especially Artificial Intelligence (AI), are transforming educational systems through the automation of processes, the personalisation of learning experiences, and the enhancement of data-driven decision-making. From intelligent tutoring systems to administrative optimisation, AI is transforming the ways in which education is accessed, delivered, and managed in diverse contexts. In numerous advanced nations, the incorporation of digital technologies has significantly enhanced institutional efficiency, lowered operational expenses, and broadened access to high-quality education. Nonetheless, in African educational institutions, the implementation of these innovations is inconsistent, hindered by infrastructural, policy, and capacity limitations.

Effective educational management is crucial for achieving sustainable development, particularly in areas facing resource constraints and systemic inefficiencies. Educational management involves the systematic planning, organisation, direction, and control of resources to create learning environments that are inclusive, efficient, and attuned to the needs of society. In Africa, numerous institutions encounter obstacles like overcrowded classrooms, outdated data systems, inadequate

teacher training, and poor resource allocation, highlighting the pressing necessity for enhanced management practices. The incorporation of intelligent systems into management processes can greatly improve transparency, accountability, and long-term planning elements that are crucial for the realisation of the Sustainable Development Goals (SDGs), especially SDG 4, which emphasises inclusive and equitable quality education.

This position paper argues that the integration of Artificial Intelligence into educational management is not only timely but also essential for promoting educational quality, efficiency and equity in African institutions. AI has the potential to act as a powerful catalyst for sustainable development by addressing persistent administrative bottlenecks, optimizing resource use, and enabling real-time decision-making. Therefore, African governments and educational stakeholders must prioritize AI adoption in policy and practice to create resilient and future-ready education systems.

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, particularly computer systems. These processes include learning (the acquisition of information and rules for using it), reasoning (using rules to reach conclusions), and self-correction, (Jarrahi, Askay, Eshraghi & Smith, 2023). In education, AI manifests in various forms such as intelligent tutoring systems, predictive analytics, automated administrative tasks, virtual assistants, and adaptive learning platforms. These applications enable systems to analyze large sets of educational data, recognize patterns, and make informed decisions that support both teaching and institutional management. AI's ability to process and act upon complex data in real time makes it an invaluable tool for enhancing efficiency and responsiveness within education systems, (Haleem et. al, 2022)

According to Connolly et. al, (2019), educational management involves the systematic planning, organizing, staffing, directing, and controlling of resources to achieve educational goals effectively and efficiently. Planning entails setting objectives and determining the best strategies to achieve them. Organizing involves arranging resources and tasks to implement the plans. Staffing includes recruiting, training, and retaining competent personnel. Directing ensures that staff are guided and motivated toward institutional goals, while controlling involves monitoring performance and making adjustments to stay aligned with objectives. Effective educational management is the backbone of any functional education system, ensuring that learning environments operate smoothly, resources are well-utilized, and students receive quality instruction.

Despite progress in some areas, the African education landscape continues to face significant challenges. Many institutions suffer from inadequate infrastructure, including limited access to electricity, internet, and modern learning facilities (Combrink et. al, 2023). Administrative processes are often manual and inefficient, resulting in poor data management and delays in decision-making. Additionally, there is a shortage of qualified teachers and a lack of professional development opportunities for educational leaders (Barakabitze et. al, 2019). These issues hinder the ability of schools and ministries to plan effectively, monitor progress, and implement policies that could improve educational outcomes. The absence of reliable data also complicates efforts to address disparities in access, equity, and quality of education across different regions.

Alharbi and Köprülü, (2024) affirmed that the integrating AI into educational management holds great promise for addressing these systemic challenges and advancing the United Nations' Sustainable Development Goals (SDGs), particularly SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. AI can support data-driven decision-making, automate administrative processes, personalize student learning, and enhance

teacher support systems. These improvements directly contribute to educational equity, efficiency, and effectiveness. Furthermore, AI-enabled tools can help identify students at risk of dropping out, allocate resources based on need, and monitor progress toward national education targets. In this way, AI serves as a strategic enabler in the pursuit of sustainable and inclusive educational development across the African continent, (Alharbi & Köprülü, 2024).

Owan et. al. (2023) Artificial Intelligence significantly contributes to the advancement of the United Nations' Sustainable Development Goals (SDGs), especially SDG 4, which seeks to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." AI technology can considerably improve the provision and administration of education by tackling persistent issues such as unequal access, inadequate instructional resources, and ineffective management. AI-driven adaptive learning platforms may customise training to meet the unique demands and learning speeds of individual students, hence facilitating inclusive education for learners with varied skills and backgrounds. Intelligent technologies can aid in recognising learning deficiencies and forecasting dropout risks, facilitating prompt interventions that enhance student retention and achievement. Furthermore, Susilo & Aritonang, (2023) agreed that AI enhances planning and policy formulation by delivering precise, real-time data on student performance, resource distribution, and institutional efficacy. In the overarching framework of sustainable development, these competencies contribute to the establishment of resilient education systems that are informed by data, equitable, and forward-looking. AI acts as a vital catalyst for excellent education in Africa by fostering innovation, enhancing accountability, and broadening educational access in rural and underserved areas, thereby significantly contributing to the attainment of SDG 4.

Benefits of Artificial Intelligence in Education Administration

Recent studies and global experiences indicate that a significant advantage of incorporating Artificial Intelligence (AI) into educational management is the automation of routine administrative tasks. In numerous African institutions, activities like student registration, class scheduling, attendance tracking, record keeping, and grading have historically required considerable time and human resources. In instances where these processes are conducted manually, it is common to encounter inefficiencies, human error, and data loss as significant challenges. Findings suggest that AI-driven systems can enhance these operations, significantly alleviating the administrative load on personnel and allowing them to focus on more strategic tasks. AI-enabled dashboards have been shown to deliver real-time insights into student enrolment patterns, staff allocation, and facility usage, enhancing institutional responsiveness and the accuracy of decision-making (Gwagwa, Kraemer-Mbula, Rizk, Rutenberg, & De Beer, 2020).

Moreover, empirical evidence highlights that successful educational planning and policy execution is significantly reliant on the presence of precise and prompt data. The lack of a strong data management infrastructure in numerous African education systems has obstructed significant reform efforts. Advanced technologies provide robust mechanisms for collecting, examining, and understanding extensive datasets, thus facilitating informed decision-making. Predictive analytics has been employed to anticipate trends in student performance, pinpoint learners at risk or schools that are underperforming, and assess the effectiveness of teaching interventions. Research indicates that AI aids national education authorities in monitoring advancements towards strategic goals and international standards, particularly those outlined in the Sustainable Development Goals (SDGs), with a focus on SDG 4 (Quality Education). This transition to data-informed decision-making boosts policy adaptability and increases transparency in the management of education, (Ananyi & Somieari-Pepple, 2023).

The findings emphasise the capability of AI to revolutionise traditional, standardised education frameworks into more tailored and inclusive learning environments. AI-driven adaptive learning technologies can customise instructional content to meet the unique needs, learning speeds, and preferences of each student. This method has shown to be especially successful in varied African classrooms where students frequently differ in language skills, foundational knowledge, and preparedness for academic challenges. Studies indicate that AI-driven platforms are capable of providing targeted remediation, supplemental content, or adaptive assessments that enhance learner engagement and success. Furthermore, the implementation of assistive AI tools like speech-to-text and translation applications has demonstrated potential in improving educational access for individuals with disabilities and those located in remote, underserved regions (Pedro, et al., 2019).

In tackling the ongoing challenge of inefficient resource utilisation, numerous case studies have illustrated the ability of AI systems to enhance the distribution of human, financial, and material resources. Algorithms powered by artificial intelligence have been utilised to examine trends in enrolment and attendance, forecast staffing requirements, and inform the allocation of textbooks or infrastructure investments. This optimisation guarantees that educational resources align effectively with the needs of the institution. Furthermore, the implementation of AI in budget planning and financial forecasting has been linked to decreased operational costs and enhanced accountability via automated reporting and inventory management. The capabilities outlined here play a crucial role in enhancing the sustainability and resilience of education systems, especially in contexts with limited resources (Ahmed et. al., 2025).

Ultimately, findings indicate that the incorporation of AI in educational management plays a crucial role in advancing wider innovation and development objectives. The digitisation and enhancement of institutional processes through AI lead to the development of more adaptable, skilled, and forward-thinking learners, who are essential for driving sustainable economic growth. In addition to its connection with SDG 4, the incorporation of AI fosters SDG 8 (Decent Work and Economic Growth) and SDG 9 (industry, innovation, and infrastructure) by enhancing capacity for lifelong learning and facilitating digital transformation. Therefore, AI serves not just as a technical tool but as a strategic driver for enhancing sustainable development via education in Africa (Patel & Ragolane, 2024).

Challenges and Barriers to AI Integration in African Educational Management

The incorporation of Artificial Intelligence (AI) into educational management systems offers a range of benefits; however, various challenges and concerns have been highlighted in academic literature and policy reports. A significant challenge observed in various African settings is the digital divide, which restricts access to the necessary infrastructure for successful AI implementation. Research by Moner-Girona and colleagues (2025) indicates that numerous public schools in Sub-Saharan Africa continue to function without dependable electricity, internet access, or modern computer equipment. The implementation of AI is predominantly limited to prestigious urban institutions, thereby exacerbating the educational equity divide between students in rural areas and those in urban settings. This infrastructural limitation presents a considerable obstacle to the extensive integration of AI and highlights the necessity for focused investments in digital infrastructure.

Another significant issue emphasised in recent studies pertains to ethical, privacy, and data protection challenges linked to the implementation of AI in educational settings. AI systems depend significantly on gathering and examining extensive amounts of sensitive student data, such as academic performance, personal identifiers, and behavioural patterns. Without strong

regulatory frameworks, the potential for data misuse, surveillance, or algorithmic bias significantly increases. For example, findings from Gurov (2025) have highlighted concerns regarding the possibility of AI algorithms exacerbating current socio-economic inequalities or marginalising certain groups from essential educational opportunities. Consequently, specialists advocate for the creation of explicit ethical guidelines and data governance protocols to guarantee the responsible application of AI in educational environments.

Furthermore, the apprehension regarding job displacement among education professionals has surfaced as a notable obstacle to the integration of AI in schools and administrative offices. Educators and support personnel frequently view AI tools as a potential risk to their job security, especially as functions like grading, lesson planning, and admissions management are increasingly automated. Nonetheless, current research indicates that AI is more inclined to enhance human roles rather than supplant them. For instance, a study by Wongmahesak et al (2025) highlights that AI has the potential to alleviate educators from monotonous administrative tasks, enabling them to concentrate on more impactful student interaction and instructional planning. Nonetheless, addressing resistance will necessitate strong change management approaches, incorporating professional development initiatives that prepare educators with digital competencies and highlight AI as a partner in the process rather than a replacement for human decision-making.

Moreover, the preparedness and ability of institutions to adopt and maintain AI solutions continue to be a significant issue. Findings from pilot programs in Kenya, Nigeria, and Ghana indicate that numerous educational institutions do not possess the necessary technical expertise and sustainable support frameworks to successfully implement AI-based systems (Belloula, 2025). Inadequate training for administrators, IT support teams, and educators heightens the likelihood of system failure or abandonment. Therefore, effective integration of AI necessitates not just the necessary infrastructure but also a commitment to developing human capital, ongoing technical support, and alignment with relevant policies.

Despite these challenges, findings consistently show that the long-term advantages of AI integration surpass the initial limitations—assuming that implementation is directed by inclusive, ethical, and context-sensitive approaches. Proactively addressing these barriers through policy reform, capacity-building initiatives, and public-private partnerships is crucial for unlocking the transformative potential of AI in education systems across Africa.

Conclusion

Artificial Intelligence serves as a significant and relevant approach to tackling the ongoing inefficiencies, inequities, and constraints that define numerous education systems across Africa. The capacity to enhance administrative workflows, tailor educational experiences, and facilitate data-informed decision-making establishes it as a pivotal factor in fostering sustainable change in education. The advantages are significant; however, the obstacles—spanning infrastructural shortcomings, ethical dilemmas, and institutional pushback—should not be overlooked. Overcoming these obstacles necessitates forward-thinking, inclusive, and principled strategies informed by strong policy structures, targeted investments, and ongoing capacity-building initiatives. This position paper has shown that incorporating AI into educational management is not just a technological upgrade but a crucial development that aligns with global educational priorities like SDG 4. African governments, policymakers, and educational stakeholders must recognise that the future hinges on integrating AI not as a substitute for human involvement, but as an essential collaborator in developing inclusive, efficient, and adaptable learning systems.

Through this approach, Africa can fully leverage AI to create educational institutions that are robust, innovative, and attuned to the diverse needs of all learners.

Policy Recommendations and Way Forward

Given the revolutionary potential of Artificial Intelligence (AI) in educational management, as well as the structural and ethical obstacles revealed, African institutions require a set of strategic policy suggestions to ensure successful adoption. These guidelines emphasise inclusive planning, capacity building, and long-term investment to ensure that AI integration aligns with the larger aims of educational equity and sustainable development.

1. African countries should create national policy frameworks that define the scope, purpose, ethical bounds, and data governance systems for AI in education to ensure responsible and effective implementation. These frameworks should be consistent with regional and international norms, such as the African Union's Digital Education Strategy and UNESCO's recommendations on AI ethics. Such policies must also include safeguards for preserving student data privacy, reducing algorithmic bias, and assuring equitable access and outcomes.

2. Addressing the digital divide is crucial for any AI-driven educational reform. Policymakers should prioritise investments in digital infrastructure, particularly in underserved rural and peri-urban areas. This entails providing stable energy, broadband internet, and appropriate computing devices in all public schools. Public-private partnerships can be used to hasten infrastructure development, with technology companies receiving unique incentives to assist inclusive digital education programs.

3. The lack of competent professionals to install, manage, and support AI technologies in educational contexts is a significant hurdle to its inclusion. Governments and education ministries should provide ongoing professional development opportunities for school leaders, administrators, teachers, and IT professionals. These programs should emphasise digital literacy, data analysis, AI tool use, and ethical issues. In addition, curriculum changes at teacher-training institutions should incorporate modules on emerging technologies and artificial intelligence in education.

4. Successfully implementing AI in education involves collaboration among governments, academia, civil society, and the corporate sector. Establishing national or regional EdTech innovation hubs can help with research, pilot projects, and knowledge sharing about best practices for AI integration. These centres can also function as incubators for context-specific AI solutions that are relevant to African pedagogical, linguistic, and socioeconomic realities.

5. Adapting AI solutions to local contexts ensures cultural relevance, language accessibility, and practical usability. This includes creating AI interfaces in indigenous languages, assisting low-literacy users, and designing adaptations for students with disabilities. Implementation methods must prioritise inclusion while avoiding exacerbating existing inequities. Pilot programs and staged rollouts can assist uncover context-specific barriers and develop tactics prior to full-scale implementation.

6. Implement a strong monitoring and evaluation (M&E) structure for all AI activities from the start. Key performance indicators (KPIs) should measure the influence on learning outcomes, administrative efficiency, equity, and cost effectiveness. Lessons from trial deployments should guide national scaling efforts. Evaluation findings should also be used to steer iterative adjustments to AI tools and policies, ensuring that they remain in line with educational aims and community needs.

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TEACHERS' JOB COMMITMENT IN PUBLIC SECONDARY SCHOOLS IN SOUTHWEST, NIGERIA

Babatunde Joseph Kolashi, (PhD)

*Department of Educational Management, Faculty of Education,
Lead City University Ibadan, Oyo State Nigeria.
kolashi.babatunde@lcu.edu.ng*

Introduction

Teachers are extremely valuable assets that play a significant part in the accomplishment of goals and objectives in any educational sector, whether it is primary, secondary, or tertiary. Without them, education would not be possible. Because of the important role they play in the accomplishment of educational objectives, it is imperative that teachers demonstrate a high level of commitment to their work. In addition, there is a need to investigate the level of commitment shown by teachers in secondary schools, as well as the factors that could play a role in influencing their level of commitment, particularly with the intention of making certain that the educational goals are met.

The concept of job commitment involves a strong and interdependent connection between the employees and the organization in which they are employed. The establishment of a strong bond between an employer and employee should ideally begin at the point of recruitment and endure over time until the employee's retirement. The establishment of commitment is a crucial component in achieving effective human resource management within an organization. The significant contribution of an individual is crucial in attaining the collective goals and objectives of an organization. It is therefore an inescapable matter that warrants the attention of the managerial personnel, board of directors, and policy-makers within an organization. Furthermore, there exists a significant correlation between organizational commitment and job satisfaction, which ultimately leads to improved job performance in fulfilling assigned responsibilities.

Commitment to a job is defined as the individual's intention to remain in the job; an identification with the values and goals of the job; and a willingness to exert additional effort on behalf of the job¹. Commitment to a job is characterized by an intention to remain on the job. It generally reflects the degree to which an individual is content with his or her work as a result of the nature of the work being performed and the attachment to the organisation². A strong belief in and acceptance of the school's goals and values, as well as a willingness to exert considerable effort on behalf of the school and invest personal resources into the teaching task, are the characteristics that define a teacher's commitment to their job. This allows the teacher to continue working in the teaching profession³. Teachers who have a strong commitment to their jobs find it easy to be interested in whatever is being done in schools, and these teachers are able to participate in school activities with their wholeheartedly without lowering the quality of their instruction².

The role of the teacher is pivotal throughout the educational process because they are charged with a wide range of critical responsibilities. However, without committed teachers who are the primary agents of facilitation in the educational process, it is impossible for the school to achieve its educational goals and objectives⁴. As a profession that helps people build better lives, teaching calls for people who are willing to go above and beyond official requirements in order to assist schools and students in achieving their objectives⁵. In point of fact, a high level of passion, love, sacrifice, and commitment to students, schools, and teaching as a profession are required for

teachers to effectively fulfill their multidimensional roles as facilitators, role models, mentors, fathers and mothers².

Without committed teachers, it is impossible to improve the academic performance and overall well-being of students in schools, as well as the growth and success of schools and the educational development of a nation⁶. This is due to the fact that committed teachers take on the problems of their school or their students as their own, and they are always ready and passionate about doing whatever it takes to find solutions to such problems⁷.

In the majority of studies, determining whether or not a teacher is committed requires looking at their dedication to the school they work at, the students they instruct, and the teaching profession to which they belong^{2, 4, 7}.

This study examines teachers' commitment in these three areas (that is, their commitment to the school, the student and the teaching profession). Teachers' job commitment is defined as the teachers' belief in and acceptance of the goals and values of the institution, as well as a strong desire to continue membership in the school. It refers to the degree to which educators are willing to embrace a school's mission, policies, and programming^{2,3}.

A teacher who is committed to his/her profession will always be willing to contribute, when and where it is appropriate, to the school's curriculum as well as extra-curricular activities, all in the interest of advancing the educational institution. In addition to this, he or she will be prepared to protect and promote the school's image and will find it easy to comply with the school's policies and laws². Teachers who are committed to the institution they work at are also likely to be committed to the goals of the institution.

Teachers who are committed to the school objectives are more likely to believe in and act upon the goals of the school, intend to remain as members of the school, work harder, and are less likely to leave the workplace. They also devote more time to relevant activities in order to accomplish the goals of the school, influence students' achievement, and exert efforts that go beyond their own personal interests to bring about desirable outcomes⁴. In addition, highly committed teachers consistently go above and beyond the requirements of their jobs. He or she is dedicated to making certain that the objectives of secondary education, as outlined in the National Policy on Education, are met in all respects and aspects of the system. This individual demonstrates a dedication to the school's short-term as well as long-term goals, objectives, and outcomes².

Statement of the Problem

Dedication among teachers has been noted in public secondary schools located in the Southwestern part of Nigeria, as they appear to have decreased investing effort into delivering their lessons in an engaging and inspiring manner. Teachers just engage in teaching not because they have a personal affinity for the profession. The teachers exhibit a lack of enthusiasm towards their duties, demonstrate minimal interest in the academic development of their students, frequently exhibit absenteeism, and fail to attend their teaching sessions. Scholars have also documented inadequate dedication among teachers¹

Aim and Objectives of the Study

The aim of this study was to investigate teachers' job commitment in public secondary schools in Southwest, Nigeria.

The objectives are to:

1. identify the level of teachers' job commitment (to School, Profession and Students) in public secondary schools in Southwest, Nigeria;

Research Questions

1. What is the level of teachers' job commitment (to School, Profession and Students) in secondary schools in Southwest, Nigeria?

Operational Definitions of Terms

Teachers' Job Commitment: Job commitment pertains to the level of attraction and attachment that a teacher feels towards their work and the organization they are affiliated with. It pertains to the socio-psychological attachment of an individual to their group or organization, including its objectives and principles, or to their chosen occupation and profession.

Commitment to the School: This refers to teachers' belief, and acceptance of the goals, policies, programme and values of the school, and strong desire to maintain membership in the school.

Commitment to the Students: Teachers commitment to students involved being dedicated to their students and is able to make the activities in the classroom more meaningful, as well as introduce new methods of applying educational resources and modify the instructional materials in such a way that they are more applicable to the students' lives and hold more of their interest.

Teachers' Commitment to the Profession: Teachers' commitment to the teaching profession involves an affective attachment to the profession or occupation, which is associated with personal identification with the career and satisfaction as a teacher

Job Commitment among Secondary School Teachers

Teachers' commitment refers to their emotional dedication to the objectives and principles of a school organisation. This type of commitment necessitates teachers to fulfil their role exclusively for the betterment of the school organisation, aligning with its goals and values¹⁵. The teacher plays a central role in the educational system and carries out important responsibilities. The achievement of educational goals and objectives in a school system relies heavily on dedicated teachers who play a crucial role in facilitating teaching and learning. Teaching, as a profession focused on personal development, necessitates individuals who exceed formal expectations to support the school and students in attaining their objectives. The multifaceted roles of teachers, including facilitation, role modelling, mentoring, and providing parental support, require a strong commitment, passion, sacrifice, and attachment to students, schools, and the teaching profession. Job commitment in secondary schools refers to teachers' willingness to invest personal resources in their teaching duties and remain in the profession. Teachers' job commitment encompasses a strong belief in and acceptance of the school's goals and values, a willingness to exert significant effort on behalf of the school, and a strong desire to maintain membership within the school. Teachers with strong job commitment are easily engaged in school activities and demonstrate wholehearted involvement without compromising standards.

Dimensions of Teachers' Job Commitment in Secondary Schools

Teachers' job commitment in any school could be generally categorized into four, which are:

1. Teachers' commitment to the institution.
2. Teachers' commitment to the students.
3. Teachers' commitment to the teaching occupation or profession and
4. Teachers' commitment to outcomes or objectives²¹.

1. Teachers' Commitment to the institution (School): Teachers' commitment to educational institutions refers to their belief in and acceptance of the goals and values of the institution, as well as their strong desire to maintain membership in the school. The readiness of teachers to accept the goals, policies, and programmes of a school is important. A dedicated teacher actively contributes to both curricula and extra-curricular activities in order to advance the school. In addition, a dedicated teacher is typically willing to safeguard and enhance the reputation of the school and adept at navigating its policies and regulations²¹. Teacher's level of organisational commitment can vary, ranging from high to low. Teachers who are highly committed are less likely to leave their teaching profession and have lower rates of absenteeism. In contrast, teachers with low commitment often engage in other activities, such as caring for their families or seeking more attractive opportunities in urban areas, leading to higher rates of absenteeism. The level of teachers' commitment to the institution is determined by the extent to which they find satisfaction and agreement between their personal expectations and the school's expectations of them. This satisfaction motivates his dedication and willingness to invest his time and energy in the school's success, while also maintaining his membership in the school. The readiness of teachers to accept the goals, policies, and programmes of a school is also important. The individual expresses a strong commitment to monitoring and safeguarding all aspects of the school, including its reputation. This establishes a connection between the teacher and the students⁵⁷.

2. Teachers' Commitment to the Student: The promotion of the school fosters an emotional connection between teachers and students, motivating teachers to be committed to their profession and create a conducive learning environment for students to achieve their goals. The dedication of teachers facilitates the implementation of personalised instruction in student education. Teachers also devise strategies to enhance the quality of their instruction. When a teacher is dedicated to their students, they will willingly invest additional time in class preparation and providing assistance to struggling students. This commitment allows them to ensure that all students, including those who excel academically, are supported and able to perform at a high level. The concept of differentiation in teaching may not be feasible without dedicated teachers. Teachers must consider students' readiness, ability levels, interests, cognitive needs, and learning preferences when preparing and delivering lessons. It has been argued that teachers who demonstrate commitment to their students engage in more meaningful classroom activities, employ innovative teaching methods, and adapt instructional materials to enhance their relevance and appeal to students. Moreover, the commitment to students is predicated on the notion that teachers are willing to exert efforts for both low and high achieving students⁵⁷. A teacher who is dedicated to their students is more likely to engage with them in both curricular and extra-curricular activities, fostering a stronger connection between students and the institution's academic endeavors⁶⁰.

A dedicated teacher derives satisfaction from working with students and possesses a strong inclination to assist each student in realising their maximum potential. The author acknowledges the diversity among students in terms of their size, colour, intelligence, background, interests, and learning preferences. He assists students in advancing through developmental tasks and programmes that align with their abilities and interests. Additionally, he tailors his lessons to

accommodate the individual needs of each student in class²¹. The lack of teacher commitment leads to decreased student achievement, reduced empathy towards students, and decreased tolerance for frustration in the classroom. Teachers who lack commitment tend to develop fewer plans to improve instruction quality and may perceive teaching as burdensome⁵⁷.

3. Teachers' Commitment to the Teaching Occupation or Profession: Teachers' commitment to the teaching profession is characterised by an emotional attachment and personal identification with the career, which contributes to their satisfaction as educators¹⁷. The importance of commitment to the occupation lies in its ability to facilitate the development of essential skills, knowledge, and relationships for a successful teaching career, irrespective of school circumstances. Teachers are expected to develop the necessary skills, relationships, and instructional practices for a successful career.

A dedicated teacher will acknowledge and fulfil their professional obligations to students, colleagues, administrators, parents, and the community. He actively participates in local, state, and national professional associations and is always prepared to advocate for the profession when needed. The individual should also have an interest in participating in refresher courses to stay updated on developments and global best practices in the profession²¹. Furthermore, he is willing to join or associate with teaching bodies at the local, state, or national level. The individual takes pride in their role as a teacher, despite the lack of recognition for teachers in their society or country. They express a willingness to remain in the teaching profession for an extended period, potentially until retirement.

Consequences of Teachers Job Commitment

The consequences of workplace commitment refer to the effects and outcomes that arise from the commitment of both the organisation and individual employees⁶¹. Academics that possess a high level of organisational affective commitment are emotionally connected to the organisation, resulting in a stronger motivation to make meaningful contributions, lower absenteeism rates, increased effort, and improved job performance⁶². Teachers who have a strong affective commitment tend to demonstrate higher levels of compliance with strategic decisions and are more willing to engage in organisational citizenship or extra role performance (^{7, 50&51}). Extra-role performance encompasses behaviours that surpass the expectations of one's job responsibilities. Examples include providing additional assistance to colleagues, volunteering for special work assignments, demonstrating exceptional consideration towards employees and students, arriving early or staying late, and offering suggestions to address problems.

Affective commitment is associated with heightened competitiveness, accountability, and the motivation to enhance overall job performance. Teachers with high levels of commitment experience lower stress levels despite working longer and harder than their less committed counterparts⁶³. Affective commitment is associated with increased motivation and reduced psychological and physical work-related stress, as well as decreased emotional exhaustion and depersonalisation^{64 & 65}. Teachers who are dedicated to their school organisation and careers tend to experience greater happiness and have more time to devote to their families and hobbies⁶⁴.

The commitment of teachers to work groups has been found to enhance team performance, pro-social behaviour, group cohesion, as well as individual job performance and satisfaction⁶⁶. Individuals who are dedicated to their jobs or careers exhibit reduced absenteeism, lower intentions to quit, heightened job satisfaction, and increased intrinsic motivation⁶⁷. The commitment and job involvement of teachers have an impact on their job satisfaction, turnover intention, role stress, productivity, and job migration^{34, 65&68}

Population of the Study

The population of this study comprised of all the principals (two thousand two hundred and sixty two (2,262)), male and female teachers (fifty six thousand eight hundred and twenty seven (56,827)) in the Southwest states (Oyo, Ogun, Osun, Ondo, Lagos and Ekiti). As at the time of the study, there were a total of two thousand two hundred and sixty two (2,262) public secondary schools in the Southwest states³. The schools are distributed over the eighteen (18) senatorial districts in all the the Southwest states. The distribution of schools by State and senatorial district is presented in the table 3.1

Table 3.1: Population of the Study (N= 56,827, Teachers and 2,262 Principals)

S/N	South States	West	Senatorial District	Number of Public Secondary Schools	Number of Public Secondary Schools Principals	Number of Public Secondary School Teachers		
						Male	Female	total
1	Lagos		Lagos Central	74	74	776	804	1,580
			Lagos East	88	88	962	1,376	2,338
			Lagos West	160	160	1,955	2,967	4,922
			Sub Total	322	322	3,693	5,147	8,840
2	Ekiti		Ekiti Central	159	159	884	1,988	2,872
			Ekiti East	57	57	818	1,224	2,042
			Ekiti West	64	64	852	901	1,753
			Sub Total	280	280	2,554	4,113	6,667
3	Oyo		Oyo Central	244	244	2,325	3,073	5,398
			Oyo North	171	171	1,819	1,337	3,156
			Oyo South	210	210	2,194	3,760	5,954
			Sub Total	625	625	6,338	8,167	14,508
4	Osun		Osun Central	112	112	881	1,525	2,406
			Osun East	159	159	610	883	1,493
			Osun West	123	123	717	772	1,394
			Sub Total	394	394	2,208	3,130	5,338
5	Ogun		Ogun Central	100	100	1,761	3,403	5,164
			Ogun East	134	134	1,950	2,832	4,783
			Ogun West	108	108	1,409	1,607	3,016
			Sub Total	342	342	5,130	7,842	12,962
6	Ondo		Ondo Central	103	103	1,402	3,013	4,415
			Ondo North	89	89	1,102	945	2,047
			Ondo south	107	107	1,321	729	2,050
			Sub Total	229	229	3,825	4,687	8,512
Grand Total				2,262	2,262	23,738	33,089	56,827

Source: ³

Teachers' Job Commitment Questionnaire (TJCQ)

This questionnaire was divided into two (2) sections.

Section A consisted of demographic information of the principals such as gender, age, marital status, years of teaching experience and highest educational qualifications

Section B contained questions on the level of commitment amongst secondary school teachers. This section answered the research question one of the study. The rating technique for section was based on the following:

Very High Level (VHL) – 6 points,

High Level (HL) – 5 points,

Moderate Level (ML) – 4 points,

Low Level (LL) – 3 points,
 Very Low Level (VLL) – 2 points and
 Not At All (NAA) – 1 point.

Answers to Research Questions

Research Question One: What is the level of teachers' job commitment in secondary schools in Southwest, Nigeria?

Table 4.4.1: Level of Teachers' Job Commitment (i) (To Student)

S / N	Item ("My teachers")	VHL (%)	HL (%)	ML (%)	LL (%)	VL L	NAA	M	SD
1	establish an effective learning environment, to allow students reach their targets	221 (22.1)	690 (69)	89 (8.9)	0 (0)	0 (0)	0 (0)	5.13	0.54
2	develop plans to improve the quality of instructions	32 (3.2)	879 (87.9)	83 (8.3)	6 (0.6)	0 (0)	0 (0)	4.94	0.37
3	find it easy to spend extra time in preparing for the class	12 (1.2)	703 (70.3)	226 (22.6)	59 (5.9)	0 (0)	0 (0)	4.67	0.60
4	are willing to help the weak students in the class in order to be able to match up with their high flier counterparts in the class academically	0 (0)	784 (78.4)	209 (20.9)	7 (0.7)	0 (0)	0 (0)	4.78	0.43
5	are willing to exert efforts on behalf of both low and high achieving students	185 (18.5)	623 (62.3)	192 (19.2)	0 (0)	0 (0)	0 (0)	4.99	0.61
6	enjoy working with students	54 (5.4)	770 (77)	163 (16.3)	13 (1.3)	0 (0)	0 (0)	4.87	0.50
7	have a strong desire to help each student develop his/her full potential	95 (9.5)	731 (73.1)	174 (17.4)	0 (0)	0 (0)	0 (0)	4.92	0.51
8	are willing to help each student progress through developmental tasks and programmes commensurate with the student's ability and interest	12 (1.2)	826 (82.6)	121 (12.1)	41 (4.1)	0 (0)	0 (0)	4.81	0.51
9	deliberately plans and designs their lessons in a way that will meet the need of each student in class	107 (10.7)	757 (75.7)	67 (6.7)	69 (6.9)	0 (0)	0 (0)	4.90	0.66

10	are willing to work with students in both curricular and extra-curricular activities which help students to connect to the institution and its academic activities	171 (17.1)	696 (69.6)	133 (13.3)	0 (0)	0 (0)	0 (0)	5.03	0.55
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Table 4.4.2: Level of Teachers' Job Commitment (ii) (To School)

S/N	Item ("My teachers")	VHL (%)	HL (%)	ML (%)	LL (%)	VLL	NA A	M	SD
1	believe and accept the goals and values of the school	301 (30.1)	458 (45.8)	160 (16)	81 (8.1)	0 (0)	0 (0)	4.9 8	0.89
1	are willing to exert effort to act upon the goals of the school	99 (9.9)	554 (55.4)	347 (34.7)	0 (0)	0 (0)	0 (0)	4.7 5	0.62
1	have a strong desire to maintain membership in the school	18 (1.8)	736 (73.6)	246 (24.6)	0 (0)	0 (0)	0 (0)	4.7 7	0.46
1	are willing to contribute when necessary to curricula and extra-curricular activities, all in the bid to move the school forward	78 (7.8)	817 (81.7)	70 (7.0)	35 (3.5)	0 (0)	0 (0)	4.9 4	0.53
1	are ready to protect and defend the school	56 (5.6)	672 (67.2)	227 (22.7)	0 (0)	0 (0)	0 (0)	4.7 8	0.53
1	find it easy to cope with school's policies, laws and regulations	0 (0)	607 (60.7)	315 (31.5)	78 (7.8)	0 (0)	0 (0)	4.5 3	0.64
1	are willing to spend time and energy for the school's success	97 (9.7)	818 (81.8)	85 (8.5)	0 (0)	0 (0)	0 (0)	5.0 1	0.43
1	place the school's interest above personal interest	0 (0)	829 (82.9)	162 (16.2)	9 (0.9)	0 (0)	0 (0)	4.8 2	0.41
1	readily promotes the school's image	14 (1.4)	802 (80.2)	184 (18.4)	0 (0)	0 (0)	0 (0)	4.8 3	0.41
1	are faithful to school schedules	19 (1.9)	821 (82.1)	160 (16)	0 (0)	0 (0)	0 (0)	4.8 6	0.40

Table 4.4.3: Level of Teachers' Job Commitment (iii) (To Profession)

S/N	Item ("My teachers")	VHL (%)	HL (%)	ML (%)	LL (%)	VL L	NAA	M	SD
21	are proud of the teaching profession	266 (26.6)	734 (73.4)	0 (0)	0 (0)	0 (0)	0 (0)	5.27	0.44
22	show personal identification with the career and satisfaction as a teacher	445 (44.5)	555 (55.5)	0 (0)	0 (0)	0 (0)	0 (0)	5.45	0.50
23	are willing to develop the necessary skills and knowledge and relationships to have a successful career, regardless of the situations within the school	257 (25.7)	743 (74.3)	0 (0)	0 (0)	0 (0)	0 (0)	5.26	0.44
24	are active member of local, state, and national professional association of teachers	472 (47.2)	528 (52.8)	0 (0)	0 (0)	0 (0)	0 (0)	5.47	0.50

25	readily defend the teaching occupation when necessary	486 (48.6)	514 (51.4)	0 (0)	0 (0)	0 (0)	0 (0)	5.49	0.50
26	are happy to stay long in the teaching profession	346 (34.6)	583 (58.3)	71 (7.1)	0 (0)	0 (0)	0 (0)	5.28	0.58
27	have affective attachment to the teaching profession	75 (7.5)	925 (92.5)	0 (0)	0 (0)	0 (0)	0 (0)	5.08	0.26
28	engage in refreshers' courses that will help them stay abreast of happenings in the profession.	370 (37)	630 (63)	0 (0)	0 (0)	0 (0)	0 (0)	4.37	0.48
Weighted Mean = 4.88 ; S.D = 0.52; Overall Decision = High Level									

Discussion of Findings

Findings from research question one show that a significant majority of teachers are committed to establishing effective learning environments and enhancing the quality of instruction. This strong dedication is crucial for student success, as it directly impacts students' ability to reach their academic targets. The willingness to spend extra time preparing for classes further underscores teachers' dedication to effective teaching practices. Also, teachers show a remarkable willingness to support academically weaker students, ensuring that learning opportunities are equitable within the classroom. This commitment to inclusivity and supporting students of varying abilities is fundamental to promoting an inclusive learning environment where all students can thrive.

A substantial majority of teachers express pride in their profession and a strong personal identification with their career, indicating a positive perception of teaching as a valuable and esteemed profession. This sense of fulfillment and contentment is likely to contribute to high job satisfaction and overall well-being, which are important for teacher retention and the quality of education delivered. The teachers demonstrate a proactive approach towards enhancing their effectiveness in teaching, with a significant majority willing to develop the skills, knowledge, and relationships necessary for a successful career. Active participation in professional associations and a readiness to defend the teaching profession highlight a sense of advocacy and dedication to upholding the profession's reputation and integrity. While teachers exhibit a high level of commitment to their profession, the moderate level of engagement in refresher courses suggests an area for improvement. Increasing opportunities for professional development and encouraging participation in such activities can further enhance teaching effectiveness and adaptability to educational advancements.

Overall, the findings reflect a high level of commitment to the teaching profession among teachers (Weighted Mean = 4.88; S.D = 0.52) with a proactive approach towards professional growth and advocacy. These positive attitudes are crucial for fostering a supportive and effective teaching environment, ultimately benefiting students and the education system as a whole. This finding is corroborated by a study that explored teacher commitment, highlighting the importance of committed teachers for student achievement and suggesting that principals and education policymakers play a role in maintaining and elevating this commitment⁸. Also, the finding is in line with another that reported high teacher commitment. The study found that student-teachers' commitment to the teaching profession is influenced by personal characteristics, environmental factors, and learning experiences, emphasizing the significance of self-efficacy and satisfaction with teacher education programmes⁹.

Findings from research question two shows a moderate approach towards involving students in establishing rules and procedures. This suggests an opportunity to increase student engagement, potentially leading to a more collaborative and inclusive classroom environment. Engaging students in rule-setting can enhance their understanding of and commitment to classroom norms.

Transparency in disciplinary methods fosters mutual respect and understanding, indicating that teachers value an open dialogue about behavior expectations. This approach can help in building a supportive classroom culture where students feel valued and understood.

Conclusion

A committed and motivated teaching workforce is essential for fostering student motivation, engagement, and success. Therefore, educational policymakers and school administrators in Southwest Nigeria should prioritize investments in school infrastructure, professional development, and resource allocation to support teachers. By addressing these critical areas, it is possible to create a more conducive learning environment that promotes higher levels of student motivation and academic achievement in public junior secondary schools.

Recommendations

- i. provide training for teachers on effective communication techniques to foster a more collaborative and supportive classroom environment. Efficient communication can enhance teacher-student relationships, contributing to higher levels of student motivation.
- ii. allocate resources to improve the physical condition of school facilities, including classrooms, laboratories, and libraries. Ensuring a conducive physical learning environment is pivotal for both teacher commitment and student motivation.

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THE USE OF ARTIFICIAL INTELLIGENCE IN DEVELOPING SOPHISTICATED AND FLEXIBLE EVALUATION TOOLS

Ejuchegahi A. Angwaomaodoko

Kean University

ejuchegahi.angwaomaodoko@gmail.com

Abstract

Artificial intelligence is radically improving evaluation systems by introducing clever tools that deal with the shortcomings of traditional assessments. This review article looks at how AI is making a difference in current evaluation techniques, as well as how it is used in schools, hospitals, and businesses. It analyses how AI-based technologies improve both the reliability and speed of test results even as they deliver more personalized assessments than ever before. Automation is one of the main improvements highlighted such as systems that thoroughly and objectively score students, platforms that respond to their progress with newer tests, and those using analytics to observe their learning habits for any issues. They solve major difficulties with existing assessment approaches such as the challenge of scaling, making the assessment objective, and providing feedback in a reasonable amount of time. Educational apps let AI deliver custom learning sessions and real-time monitoring, while in health care, AI improves accuracy in detecting disease from different types of images. Corporate uses show that businesses rely on objective approaches to talent hunt and advanced methods to watch employees' performance. Merging AI in evaluation processes brings major ethical hurdles and difficulties in implementing it. The concerns are to ensure student records are secure, stop bias in computer-scored tests, and make sure people oversee critical assessments. There needs to be better frameworks for governance, clearer system operation, and equal use of these modern evaluation methods. This study suggests that while AI can improve how assessments are done and how quickly they take their proper use requires attention to ethical issues and constant supervision to maintain evaluation integrity everywhere.

Keywords: Artificial Intelligence, Evaluation Tools, Machine Learning, Adaptive Assessment, Automated Grading, Predictive Analytics, Ethical AI

Introduction

Artificial intelligence (AI) has changed assessment and evaluation processes, shifting from old, unchanging approaches to modern, flexible solutions. Due to recent progress in computer science, teachers can now use tools that change with new scenarios and give feedback tailored to every student. In medical education using artificial intelligence in training not only meets rigorous standards but also enhances the effectiveness of teaching and learning programs (Sriram et al., 2025). Likewise, online settings benefit from personalized learning algorithms that adjust education materials to how a learner processes information (Ali et al., 2024).

This new way of evaluating education solves several challenges found in standard evaluation methods. Many traditional assessment tools have trouble growing with schools, grading in a fair manner, and giving students feedback quickly. These tools help address these issues by using automated scoring, adaptive testing, and predictive analytics. Even so, the use of AI in evaluation raises new problems regarding how transparent algorithms are, how data is safeguarded, and how impactful evaluations are to the judgments of humans.

Aim and Objectives

This review examines the evolving role of AI in assessment systems with three primary objectives:

1. to research how AI technologies are being applied to improvise evaluation accuracy;
2. to study the implementations across of AI tools across education, healthcare, and professional certification domains; and
3. critically study the transformative potential and limitations of AI-driven assessment tools.

Scope and Significance

The emphasis of this review article is automatic grading applications that emerged between 2020 and 2024, covering automated marking, adaptable testing, and prediction analysis. The report includes case studies in education, healthcare, and professional certification that highlight the ways machine learning, natural language processing, and deep learning enhance evaluation efficiency, and quality and match individual needs. Its most valuable aspect is linking current research that demonstrates how AI is likely to transform how we evaluate students. Experts show that these technologies help more users by adding fairness, for example by the performance of ChatGPT on exams (Kamalov et al., 2023) and also address big issues like making the algorithms easily understood, securing peoples' privacy, and supervising them properly. The study looks at AI's progress and uses it to suggest helpful ways for educators, assessment experts, and policymakers to make use of AI without facing risks. The research outcomes add to existing talks about making AI-supported assessment systems valuable and fair for various groups.

The Evolution of Evaluation Tools: From Traditional to AI-Driven Systems

Traditional Evaluation Methods

Traditional evaluation systems are based on manual grading procedures and standardized testing approaches that have their own set of limitations in objectivity, scalability, and feedback quality. While manual assessment is quite detailed, the long time it takes to review worksheets often means students lose context by the time they receive results (Lee, 2021). In fields like computer science, such delays are especially significant because small errors in the code are penalized with unfairly large penalties due to the time between the code's submission and evaluation (Lee, 2021).

Many people are now criticizing standardized testing as a main feature of traditional assessment. Often, these methods insert preferences that follow inequities from the past involving race, disability, and the use of certain languages (Nair et al., 2023). For example, in speech-language therapy, using standardized tests often marks certain speaking methods as problems which keeps some populations on the margins (Nair et al., 2023). Using medical approaches to disability, these exams are mainly used to watch over students and enhance testing enterprise profits, rather than fairly judge talent. Besides bias, the usual methods have trouble dealing with practical restrictions. Doing all the markings makes it hard for teachers to input personalized advice and tests that are not adjustable to each person's progress only offer one option. Both systems focus mainly on summative assessment which prevents them from helping students improve their learning over time. Due to delays in feedback, unfair biases, and inflexible systems, it is now important for evaluation approaches to combine efficiency with fairness, a goal many are attempting to achieve using AI.

Transition to Digital and AI-Based Evaluation

The transition from paper-based to digital assessment began through computer-based testing (CBT) and learning management systems (LMS) which made it possible to administer the same tests automatically but in strict formats. COVID-19 showed that these systems could be successful in Nigeria, but it took a lot of infrastructure development for blended learning to work well (Malasowe et al., 2023). As a result, AI-assisted solutions were developed to overcome the initial

systems' weaknesses in getting feedback and adjusting. Lee (2021) showed how students could use GitHub to deposit code into a repository which automatically sets off a Jenkins CI pipeline for its evaluation.

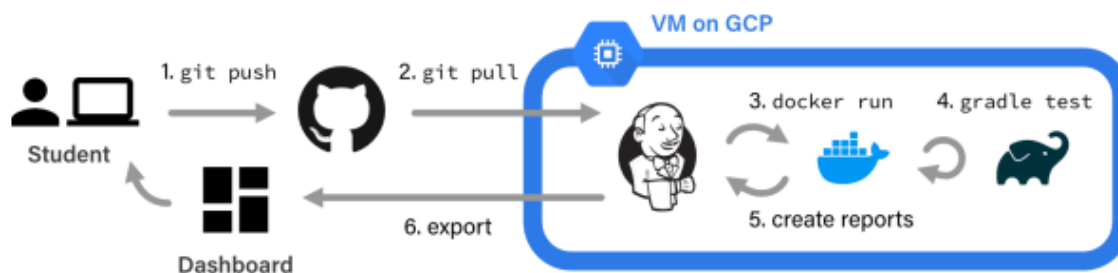


Figure 1: Workflow of automated grading and real time feedback (Source: Lee, 2021)

In the example shown in Figure 1, submissions run in Docker, unit tests are done with Gradle, and detailed feedback reports are provided within only 3 to 7 minutes to ensure students learn better and are evaluated strictly. With tools like ChatGPT coming into use, information and data collection for assessments has been made more powerful, and at the same time, it is leading to more questions about the honesty of academic work (Kamalov et al., 2023). They blend the success of early digital systems with highly personalized changes, adjusting questions and test difficulty as students position themselves. It means more than new technology: it indicates a switch from traditional to ongoing assessments that smoothly tie into student learning routines. Recent AI-based tools in education can improve assessment in three ways: letting technology control the process to reduce work for teachers, helping each student learn through individualized lessons, and adjusting to changes in a learner's skill level.

Key AI Technologies Powering Modern Evaluation Tools

Modern evaluation is undergoing a radical shift, moving beyond traditional tests to dynamic, data driven assessment. These technologies encompass machine learning, deep learning and neural networks, predictive analytics, as well as adaptive testing mechanisms.

Machine Learning (ML) in Assessment

Most evaluation systems today heavily rely on Machine Learning (ML) because its approaches allow for automatic scoring and analysis of outcomes. Large amounts of pre-graded answers are used to train supervised learning which can correctly evaluate structured answers in STEM areas by noticing patterns linked to good quality (Zhai, 2021). Specifically, they do well at judging complex science topics in NGSS-based exams, as they read evidence and decide what to score that rubrics might not notice (Zhai 2021). It does this by discovering patterns in data that have not been labelled which helps in analytical tasks by, for instance, grouping misconceptions in students' open-ended responses.

Natural Language Processing (NLP) helps ML analyse unorganized text and speech which changes the way essays, reflections, and speeches are judged. New NLP solutions study how people use language and help improve their skills in speech and writing (Caratozzolo et al., 2022). In the STEM field, NLP allows teachers to guesstimate higher thinking skills from students by reviewing project reports and papers, not just through normal testing (Caratozzolo et al., 2022). So, NLP can check how involved students are in forums and GPT-4 can explain how to write better arguments to those students. Used together, ML and NLP fill the space between standard testing and competency assessment, letting machines assess responses and help learners with specific requirements.

Deep Learning and Neural Networks

The use of deep learning architectures has made evaluation systems more advanced by making it easy to look at patterns and images in unorganized data. According to Serey et al. (2023), convolutional neural networks (CNNs) prove especially able to assess graphical or handwritten information in STEM subjects. They are particularly effective with unequal data in educational and workplace assessments since ordinary algorithms have trouble handling these kinds of data. Managing and interpreting lots of assessment data in a digital environment now depends on deep learning. In addition to CNNs, recurrent neural networks (RNNs), and generative adversarial networks (GANs) can make dynamic evaluation systems, explaining why they play a role in the analysis of time-series data and the creation of assessment items. Such tech examples help solve issues present in today's assessments, mainly in engineering and science areas where thoughtful problem-solving cannot be fully assessed with easy multiple-choice questions. Presence of these networks' pattern recognition features, both scoring accuracy and the type of performance analysis have advanced considerably. As education and testing organizations are using more digital assessment, it is becoming crucial to maintain quality and increase scale with deep learning methods. Bringing advanced technologies into assessment improves on conventional ways of measuring students, making both work easier and insights more detailed.

Predictive Analytics

Predictive analytics helps to find trends and problems early which allows for early actions in both education and training. It has been shown in financial risk assessment that these techniques grew from just basic statistics to advanced systems driven by AI for managing big data in dynamic environments (Nahar et al., 2024). Figure 2 demonstrates this by revealing how today's machine learning approaches detect more detailed performance changes than older evaluation methods could. Predictive tools in schools look at a student's previous performance to predict academic results, identify those most likely to struggle, and provide support designed for them, the same way credit risk models do. They use assessment scores, students' degree of engagement, and how they behave as sources to guide decisions.

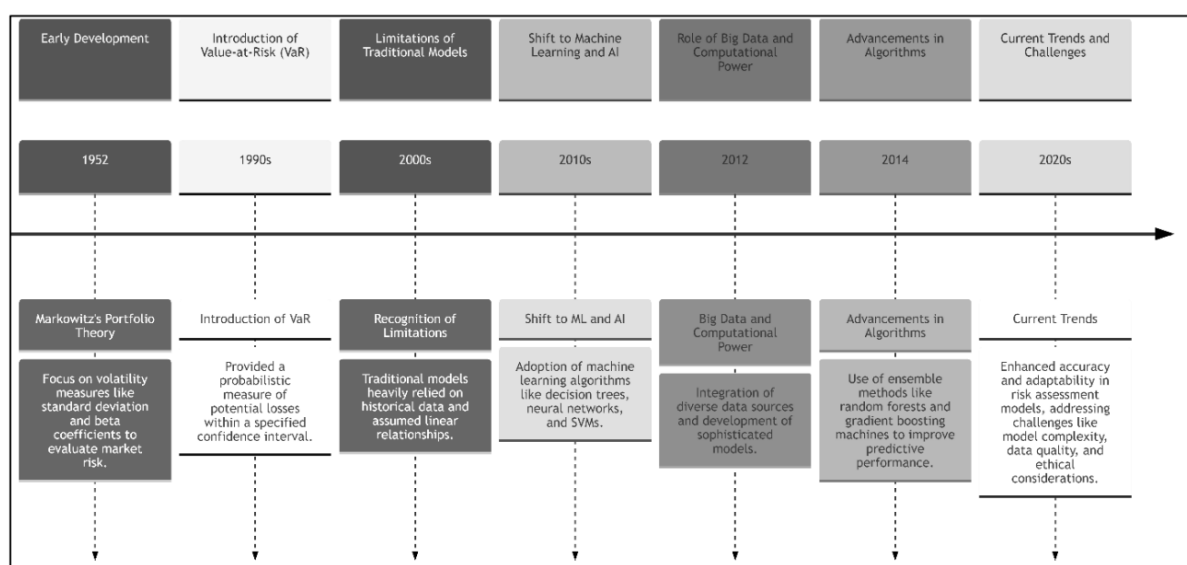


Figure 2: Evolution of predictive Analytics in finance (Source: Nahar et al., 2024)

Nahar et al. (2024) point out that these pluses are accompanied by difficulties for example, in bias in algorithms and how data can be misused. Effective use of predictive analytics means teachers and schools can identify and close problems in learning before they become more serious. The

fact that the technology can always improve its predictions with added new information is useful in competency-based systems since it monitors how learners grow in their skills. As can be seen from Figure 2, by connecting these models to evaluation systems, the results help to refine predictions which then leads to improved teaching techniques.

Adaptive Testing Mechanisms

According to recent studies of national benchmark tests, high-stakes exams using Computerized Adaptive Testing (CAT) now adjust their question difficulty to match how each examinee is performing during the test (Ayanwale et al., 2024). In tests such as the GRE and GMAT, these systems find the best possible questions for testing and significantly cut down the time, preserving accuracy. The authors state that, in their simulation study, the process requires preparing many questions for the item bank, setting strict collision rules, monitoring the control of questions, and defining when the test should stop. Knowledge assessments using fixed-length CAT were found to give very precise results (errors lower than 0.35) and handle item exposure rates well which is essential for keeping tests secure in important situations. Currently, CAT systems use item response theory (IRT) and machine learning to regularly adjust the set of questions, according to both the examinee's ability and the patterns of their answers. By tailoring the questions, exams become more accurate, since the examinees do not face too many very simple or very complicated questions. Since education assessment values both efficiency and accuracy, CAT marks a big improvement over traditional test. Still, it must be carefully set up through the item banks and watched constantly to ensure it is fair to all students or groups.

Applications of AI in Evaluation across Different Sectors

Artificial intelligence is revolutionizing evaluation across sectors spanning from education, healthcare, and other corporate parastatals.

Education Sector

Artificial intelligence has fundamentally changed assessment in the education sector, making evaluations more efficient, adaptable to individuals, and able to cover more students. With the presence of platforms like Gradescope and Turnitin, automated assessment has witnessed significant improvements, due to the advanced machine learning tools that handle grading for various assignments on these platforms. They make use of natural language processing (NLP), computer vision, and deep learning to carry out analysis of student responses (Kamalov et al., 2023). Performing many routine grading tasks automatically, these platforms take up to 70% of a teacher's work and help avoid mistakes by reducing bias and tiredness. Generative AI tools like ChatGPT have now made it possible to observe and analyse feedback as soon as it is delivered and handle a lot of responses at one time (Kamalov et al., 2023).

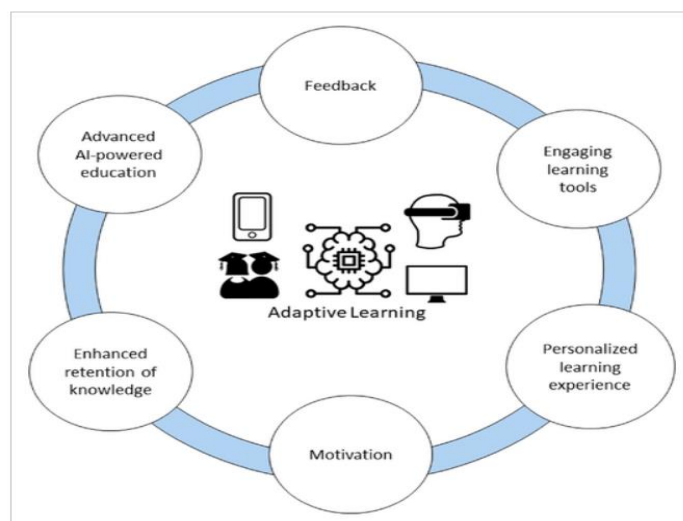


Figure 3: Framework for modern adaptive learning (Source: Strielkowski et al., 2025)

AI has advanced education through personalized learning assessment which moves away from an approach that tries to fit everyone with the same evaluation method. Through continuous analysis of student indicators, Squirrel AI and Carnegie Learning develop personalized paths for learners with the help of adaptive algorithms. As noted in Figure 3, using AI in combination with augmented reality and spatial computing allows modern adaptive learning systems to create effective ways to assess students (Strielkowski et al., 2025). Adaptive systems can handle multiple tasks such as changing the challenges, the method of presenting lessons, and when to give feedback, by following students' progress patterns. Studies conclude that AI for assessments has improved how faculty engage and the quality of assessment outcomes however, adopting these systems properly is challenging and needs careful attention to training teachers and offering a clear understanding of the AI process (Rahiman & Kodikal, 2024).

Due to AI, scores from the computer-adaptive testing (CAT) system are simpler to process and provide accurate results from large-scale assessments. These systems rely on advanced psychometric methods and use learners' current performance to continuously adapt to the difficulty of questions. As a result, assessment precision is the same as that of fixed-form tests with about 30-50% fewer questions to take. Apart from optimizing the testing process, AI-powered systems help you see how students are doing by analysing what kinds of answers they give. Even so, bringing AI to education evaluation requires attention to several matters involving ethics and everyday concerns. It is important to focus on data privacy, try to eliminate any biases built into the algorithms, and continue to have adults make the most important decisions (Kamalov et al., 2023). In the future, AI will help turn educational assessment from an old, one-time process into a dynamic, wide-ranging one that aids deeper understanding. Newer types of applications can now analyse speech, gestures, and the techniques used to solve problems along with written work.

Healthcare Sector

Advanced image analysis and predictions powered by AI have greatly improved how both diagnostics and patient monitoring are done in healthcare. AI technology helps doctors by improving their interpretation of X-rays, MRIs, and CT images with greater accuracy and permitting diagnosis in up to 30% less time (Khalifa & Albadawy, 2024). Due to these systems, it is now easier to detect very early signs of tumours and rare diseases that tend to be missed in manual reviews (Wojtara et al., 2023). The technology is applied to four main arenas: improved image analysis that won't slip up due to human fatigue, improved operations that save healthcare

resources, predictive models for advanced prevention, and aid for decisions that integrate with patient records (Khalifa & Albadawy, 2024).

AI also changes how patients are monitored by always checking data from both wearable and hospital sources. Predictive models use clinical records of vitals, DNA, and signs of treatment to spot signs of ill health long before clinical symptoms come about (Wojtara et al., 2023). In managing rare diseases, AI helps because there are few cases to study, by finding similarities in patients from different locations. While the technology can guide personalized treatment, there are still worries about how personal data and the algorithms might be abused.

Corporate and Recruitment

Using artificial intelligence allows companies to innovate their hiring and improve their analysis of employees' performance. Pymetrics and HireVue use neuroscience games and review video interviews with machine learning which helps make hiring fairer and more efficient. According to Unilever's reports, such systems can improve diversity among candidates and reduce hiring times by focusing on the assessment of crucial cognitive and emotional factors instead of handling applications manually, as in common hiring procedures (Ghoul et al., 2024).

Predictive analytics made possible by AI are changing the way workforce planning is done. IBM Watson and similar systems review performance, employee interactions, and usual job roles to find areas where retention may be a concern and recommend focused development strategies (Ghoul et al., 2024). By evaluating past resignations, employee abilities, and what's happening in the market, cutting-edge algorithms can identify skill gaps months in advance which supports proactive ways to address them (Alabi et al., 2024).

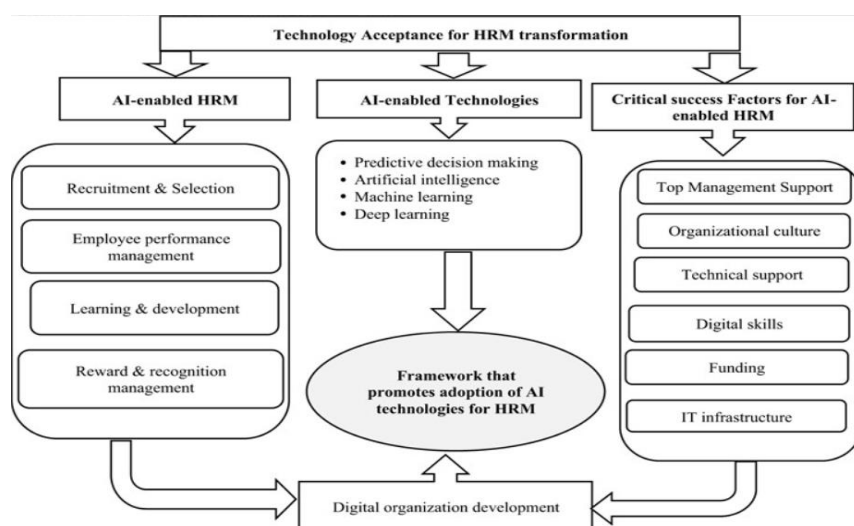


Figure 4: Adoption of AI-enabled technologies for HRM framework;
Source: Muridzi et al., 2024.

According to Figure 4, doing AI right in HR depends on joining the power of technology with the way an organization is ready for change (Muridzi et al., 2024). It explains that, while AI reduces the chance of bias in hiring and offers objective records of performance, people must also look after the process to spot algorithm flaws and keep workers' confidence. Currently, it is advised that AI analyses data and spot patterns, while HR professionals attend to key decisions and work on relationships with staff (Alabi et al., 2024). Through these technologies, organizations are looking at HR partners as strategic leaders, not just managers, and counting on them to use reliable data to shape staff decisions.

Benefits of AI-Powered Evaluation Tools

Both the quality of assessments and the running of evaluation systems have improved in education, healthcare, and the corporate world due to artificial intelligence. Gradescope and similar platforms have demonstrated how automated grading systems bring greater consistent scoring and save much time in evaluation (Kamalov et al., 2023). Adaptive methods used on standardized tests can both improve how results are measured and decrease the duration of the test by providing custom questions (Ayanwale et al., 2024). With these systems, students are evaluated well, but they have fewer exhausting tests.

Algorithms in healthcare applications have shown superior ability to detect some abnormalities in medical images, including X-rays, MRIs, and CT scans (Khalifa & Albadawy, 2024). Because of machine learning, patient monitoring can spot deterioration in a patient's condition, so treatment can start earlier (Wojtara et al., 2023). Analysis of each patient's unique data allows treatment decisions to be personalized, thanks to these technologies. Thanks to AI, companies can use it to find the right people and track their work performance. Using unbiased approaches, intelligent hiring platforms offer an effective way to look at all candidates during the selection process (Ghoul et al., 2024). Employing predictive analytics in performance systems makes it easier for employers to plan and fix employee skill gaps and risk losing them (Alabi et al., 2018).

AI makes it possible to keep assessments accurate for groups of people much larger than with traditional methods. Software in education allows customized learning for groups, whereas medical systems make diagnosis possible outside of well-equipped centers (Strielkowski et al., 2025). Candidate evaluations can be handled with speed by corporate platforms, without having to sacrifice the accuracy of the data (Ghoul et al., 2024). As these systems rely on machine learning, they are becoming more accurate in their evaluations over time (Zhai, 2021). AI supports evaluation systems by offering more objective results, improving how things are handled, and delivering valuable insights for all users. Still, AI must be handled carefully and ethically if it is to work well in modern assessment methods.

Challenges and Ethical Considerations

Utilizing artificial intelligence in testing and evaluation means that serious ethical problems need to be considered in education, healthcare, and corporate fields. Data safety and privacy issues are especially important in schools because students' confidential information is handled by these systems. Khan (2024) notes that using computers and assessment tools to handle large amounts of personal data can lead to doubts about the importance of understanding the risks involved for the people involved. Unauthorized use or business exploitation of personal data leads to the implementation of strong security and effective regulations. Balancing respect for students' privacy with the importance of academic integrity is an extra challenge educators deal with using AI-based proctoring systems.

There is now a major concern over algorithmic bias, in evaluation cases. In the world of corporate hiring, AI tools for recruitment have been shown to worsen the biases found in their training data (Albaroudi et al., 2024). Perhaps these systems work against members of particular groups due to mistakes in how they learn from the past or gather data. Even though data augmentation and vector space correction look helpful in fighting these biases, we should not forget that data remains the primary problem (Albaroudi et al., 2024). A similar issue comes up in educational assessments because algorithms might prejudice students with backgrounds or ways of learning (Khan, 2024). Just like with education, healthcare struggles because AI systems that train on narrow patient records may supply incorrect diagnoses for minority groups.

One important ethical question is when we trust too much in the computerized rating of students. In healthcare diagnostics, allowing human interaction in the process helps strengthen the bond between the doctor and patient using their AHI architectural framework (Sulaieva et al., 2024). The problem of over-automation happens in schools as well as in companies when considering people and situations that are hard for algorithms to see. Thus, balanced frameworks for implementation are a major need.

Khan (2024) explains that using federated learning assures privacy and does not block the use of AI systems. All sectors ought to set clear rules for how humans and machines should cooperate with machines supporting humans' judgment, not replacing it (Sulaieva et al., 2024). A teacher must interpret unusual results in an educational evaluation, just as a human worker needs to check the staffing recommendations given by a corporate HR system. Governance works well when AI development is clear, new decisions are examined through audits by third parties and algorithms can be reviewed by real professionals who can intervene when the output appears wrong. They are especially essential when assessments are made about medical diagnoses, qualifications, or deciding on a person's career. For AI development to be ethical, it is essential for teams of technical experts, field professionals, and ethicists to keep revisiting its implementation. With this system, evaluation is improved instead of hindered, and important steps are taken to avoid over-automation in education, healthcare, and companies.

Conclusion

The improvement of AI-based evaluation systems is reaching a key transformative phase due to generative AI and blockchain being integrated. Large language models like ChatGPT is driving progress in the way assessment responses are given. Using their current method, these systems handle everything from schoolwork and writing to judging professional abilities. The use of almost instant feedback for each learner improves evaluation tools and maintains the same standards. At this point, more people are seeing that blockchain guarantees secure credentialing and provides access to certificates that verify achievements without compromise. By combining these two methods, we can ensure the evaluation process is honest, easy to use, and resistant to fraudulent claims. Apart from this, assessment tools look at answers, the style people use when speaking, their problem-solving methods, and their emotions due to progress in computer vision and affective computing.

In the healthcare field, AI is becoming more advanced and can now help track how illnesses progress and how treatments are working, as they happen. Now, corporate talent assessment is moving forward with virtual reality and simulations that involve employees in practical scenarios for assessment. More transparent AI (XAI) methods can show both users and regulators the steps the algorithms use to make their decisions. Artificial intelligence has helped change evaluation processes in schools, hospitals, and companies, making them easier, better, and more open. With edtech, students have the chance to learn individually, medicine can be used to spot health issues sooner, and making recruitment choices is fairer. For this journey to succeed, it relies on strict regulation to address repeating issues such as privacy of data, fairness in algorithms, and ways people and AI can cooperate. Additional research should aim to create shared means of evaluating AI tools, learn about long-term AI impacts on education and work, and design new guidelines to match fast-changing technology. Any institution that uses these technologies should make sure students are trained in digital literacy, so all participants feel equal and can use the AI evaluations. Technology is there to help people, not make decisions for them, allowing the essential human aspects of assessment to stay supported.

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ARTIFICIAL INTELLIGENCE, ACADEMIC SELF-EFFICACY AND LEARNING OUTCOMES OF OFFICE TECHNOLOGY AND MANAGEMENT STUDENTS IN SOUTHWEST, NIGERIA

¹Lydia Yemisi Oludele, ²Eseza Akiror Erwat & ³Matthew Adebayo Aina

¹Lecturer, Department of Office Technology and Management,
Osun State Polytechnic, Iree, Osun State, Nigeria

²Professor in the Department of Information Management,
Lead City University, Ibadan, Oyo State, Nigeria

³Lecturer, Department of Vocational and Technical Education,
Ekiti State University, Ekiti State, Nigeria
lydiaoludele@ospoly.edu.ng

Abstract

Attainment of desired learning outcomes is one of the paramount goals of any educational system. The integration of Artificial Intelligence (AI) in educational system seems to be transforming educational systems globally, including learning outcomes. This study, thus investigated the influence of utilization of AI and academic self-efficacy on achieving learning outcomes in Office Technology and Management (OTM) students in public polytechnics, Southwest, Nigeria. Three null hypotheses were postulated. The study employed descriptive research design of survey type. The study sampled 341 from 2,327 OTM students during 2023/2024 academic session, using proportionate stratified sampling technique. A 45-item questionnaire with 3 sections adapted from literature was used for data collection. The instrument's reliability yielded Cronbach's Alpha values of 0.749, 0.784, and 0.780 for the three sections. Regression analysis and ANOVA were used to test the hypotheses at 0.05 level of significance. The study found that utilization of AI has significant but very low contribution to learning outcomes ($R^2 = .04$; $\beta = 0.384$; $t = 3.908$; $p < 0.05$), while academic self-efficacy was found to have high significant contribution to learning outcomes ($R^2 = .562$; $\beta = 0.773$; $t = 20.622$; $p < 0.05$) and utilization of AI and academic self-efficacy have combined significant influence on learning outcomes of the students ($R^2 = 0.565$; $F = 215.135$; $p < 0.05$). The study concluded that AI has low contribution to learning outcomes, resulting from the low level of utilization of AI tools by the students. But utilization of AI and academic self-efficacy have combined significant influence on learning outcomes of Office Technology and Management students in the Polytechnics in Southwest, Nigeria. It was recommended that students and teachers should intensify efforts on proper usage of AI tools in teaching and learning processes, and also redirect efforts at boosting self-efficacy level in order to boost the attainment of desired learning outcomes in the OTM students.

Keywords: Artificial Intelligence, Academic Self-efficacy, learning outcomes, Office Technology and Management, Polytechnics

Introduction

Learning outcomes are personal changes and benefits that result from students' interactions with learning environments. Learning outcomes describe observable behavioural changes in learners in terms of knowledge, skills and attitudes after specific learning experiences. These observable changes border on the three dimensions of learning outcomes as explained by Ekpenyong et al. (2023) which are cognitive, affective and psychomotor skills. Students of any successful educational programme should be able to exhibit and demonstrate evidences of comprehension

and skill acquisitions that result in change in attitude and behaviour. Achieving high level of learning outcomes in higher educational programmes directly impact on the production of high-quality human resources who will effectively contribute to national development, hence, many countries all over the world place high premium on ensuring that their higher educational programmes achieve desired learning outcomes in the learners (Li, et al., 2020). The importance of attaining high level of learning outcomes in students of Office Technology and Management in the Polytechnics cannot be overemphasized, as this directly impact the quality of graduates injected into the labour market to successfully manage the contemporary business offices. Preliminary investigations, however, have shown that the current technological trends in the area of Artificial Intelligence (AI) can pose a major influence on attainment of learning outcomes.

The recent but rapid technological advancement in the area of Artificial Intelligence (AI) has brought about transformative changes to education. Students' learning processes, interactions and professional competencies are being vastly reshaped. Many educational institutions are embracing the adoption and utilization of AI in teaching and learning processes. In the field of Office Technology and Management (OTM), adaptability to technological trends and utilization of digital tools are considered critical for proficiency and professional competencies of the diplomates. There are differing AI tools such as ChapGPT, Grammarly, Alexa, Microsoft Copilot, and the likes which are capable of enhancing OTM students' knowledge and professional competencies. Adaptive learning platforms such as DreamBox Learning and Twinkl Boost are also capable of improving students' learning outcomes (Sasikala & Ravichandran, 2024).

Utilization of AI technologies offers unprecedented opportunities for personalized learning, and enhancing learning outcomes (Raja, et al., 2024; Sasikala & Ravichandran, 2024; Wang, et al., 2024). Sasikala and Ravichandran (2024) opined that AI technologies have positive effects as well as some drawbacks on learning outcomes. Improved student engagement and personalized learning were highlighted as some of the positive impact, while ethical concerns and challenge and challenges in implementation were the drawbacks. As educational institutions increasingly adopt AI technologies for teaching-learning processes, there is a growing need to understand how accessibility and utilization of these digital tools influence learning outcomes of OTM students in preparation for optimal performance in the contemporary workplace.

Central to the adoption and utilization of AI technologies and the attainment of desired learning outcomes is the concept of self-efficacy. Self-efficacy is the students' belief in their own ability and capability to successfully organize and execute a course of action (Riopel, 2019). For students in OTM programmes, the higher the levels of academic self-efficacy, the better the learning outcomes attained. It is envisaged that the high levels of academic self-efficacy and adoption of AI-driven learning tools may significantly influence learning outcomes of the OTM students in public polytechnics across the Southwest, Nigeria. Previous studies have shown that factors such as psychological capital, organisational behaviours, motivation and emotional quotients are critical to students' learning outcomes (Firmansyah, et al, 2018; Kustyarini, 2020; Chen, et al., 2022). Some other studies established positive influence of students' self-efficacy on learning outcomes, academic performance and general academic achievements (Talsma et al., 2018; Ahmadi, 2020; Maggie, et al., 2020; Rorimpandey & Midun, 2021).

Although there have been some studies on the influence of students' self-efficacy on learning outcomes (Maggie, et al., 2020; Firmansyah, et al., 2018; Yang, et al., 2022), studies exploring the interactive influence of utilization of AI tools and students' academic self-efficacy on learning outcomes are still relatively scarce. Similarly, Sasikala and Ravichandran (2024) investigated the impact of AI on student learning outcome. The study found that AI technologies have positive

impact on learning outcome. The study however employed literature review methodology. A study conducted by Wang, et al. (2023) that seems to combine AI, students' self-efficacy and learning performance investigated the effects of higher education institutes; artificial intelligence capabilities on learning performance and self-efficacy. The study reported that artificial intelligence capability affects students' learning performance with student creativity and self-efficacy as mediating variables. Also, factors influencing learning outcomes among OTM students are sparsely explored. This study therefore focuses on exploring the separate and combined influence of utilization of AI and academic self-efficacy on learning outcomes among Office Technology and Management students in public polytechnics across the South West Nigeria. The study will highlight the influence of utilizing AI tools and the influence of students' academic self-efficacy on learning outcomes among OTM students in public polytechnics in Southwest, Nigeria. The study is grounded in Technology Acceptance Model (TAM) by Davis (1989) and Social Cognitive Theory (SCT) by Bandura (2001). The study used TAM, which underscores the influence of adoption of new technology, to analyze how AI adoption influences learning. Similarly, Social Cognitive Theory by Bandura, 1986 emphasizes self-efficacy as a determinant of learning behaviour.

Statement of Problem

Achieving required learning outcomes in Office Technology and Management students is important for the production of highly competent workforce who would manage the contemporary digital offices for maximum productivity. Despite the increasing integration of Artificial Intelligence (AI) tools in educational settings, and its perceived potential to influence learning, students of Office Technology and Management across Southwest Nigeria seem to be facing some challenges in adapting to the innovation. Although AI has the potential to personalize and influence learning, its adoption and utilization depends on students' willingness and confidence to explore usage of these technologies. There seems to be dearth of empirical evidences on how utilization of AI tools and students' academic self-efficacy interact to influence learning outcomes among OTM students in the Southwest. The results of this study would be beneficial to OTM students who will gain insights into the importance of developing self-efficacy in using AI tools for improved academic performance and professional readiness. It would also assist educators and policy makers in developing targeted interventions to improve technological readiness and academic performance of learners in the field of office management.

Hypotheses

This study specifically examined the separate and combined influence of utilization of AI tools on the learning outcomes among OTM students in Southwest, Nigeria, testing the following hypotheses:

- H₀₁: There is no significant influence of AI utilization on learning outcomes of OTM students in Southwest, Nigeria.
- H₀₂: There is no significant influence of students' academic self-efficacy on learning outcomes of OTM students in Southwest, Nigeria.
- H₀₃: There is no significant combined influence of AI utilization and academic self-efficacy on learning outcomes of OTM students in Southwest, Nigeria.

Methodology

The study adopted a descriptive survey research design, which is considered appropriate for collection of quantitative data to analyse the relationship between the variables of interest. The population of the study comprised 2,327 OTM students in accredited polytechnics across Southwest Nigeria during 2023/2024 academic session. This includes students from polytechnics offering OTM programme in Oyo, Lagos, Ogun, Ondo, Osun and Ekiti states in Nigeria.

Polytechnics with active OTM programmes were purposively sampled. Then, 341 students were sampled using proportionate stratified sampling technique. A 45-item questionnaire with 3 sections adapted from literature, and validated by experts in the field of office management and computer science, was used for data collection. Section A measured the level of adoption and utilization of AI tools such as ChatGPT, Grammarly, QuillBOt, Trello, and Microsoft Copilot. The 4-point rating scale of measurement consist items such as “I use ChatGPT to complete assignments” with the response mode of Very often = 4, Often = 3, Rarely = 2, and Never = 1. Section B measured the level of academic self-efficacy alongside two dimensions of strength and magnitude (Zuin & Findlay, 2014; Ha & Min-Jeong, 2020), with the scale comprising statements such as “I can persistently solve problems regarding my academic subjects”; “I am capable of accomplishing my performance goals in my academics” (Dullas, 2018); while Section C measured students’ cognitive and psychomotor learning outcomes with 18 items adapted from Revised Learning Indicators Scale and OTM curriculum specifications (Frymier & Houser, 1999; National Board for Technical Education, 2004). The instrument’s reliability yielded Cronbach Alpha values of 0.749, 0.784, and 0.780 respectively for the three sections. Regression analysis and ANOVA were used to test the hypotheses at 0.05 level of significance.

Results and Discussion

Table 1: Regression results on influence of AI usage on Learning Outcomes of OTM students

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
(Constant)	2.022	.185		10.937	.000
AI Utilization	.384	.098	.210	3.908	.000

$R^2=.044$; Adjusted $R=.041$; $p<0.05$ (Significant)
Dependent variable: Learning Outcomes

Source: Researcher’s SPSS Analysis Output, 2025

From Table 1, the regression can be given as $y = 2.022 + (0.384)X_1$, where X_1 is AI Utilization. The implication is that when all variables are held constant, AI Utilization will be at the intercept of 2.022. A unit increase in AI Utilization will results in 0.384 increase in learning outcomes of the OTM students. This implies AI Utilization will have significant but low influence on learning outcomes of OTM students. R^2 of .044 also reveals that the level at which OTM students utilize AI technologies determine only 0.044 of learning outcomes. AI utilization accounts for 4.4% of variation in learning outcomes among OTM students in public polytechnics in South-west, Nigeria. The influence, though very low, is significant ($\beta = .210$; $P < 0.05$). Based on this, H_{01} , which stated that there is no significant influence of AI utilization on learning outcomes of OTM students in Southwest, Nigeria is not accepted.

This corroborates the finding of Sasikala and Ravichandran (2024) that AI has positive influence on learning outcomes. The low level of influence may however suggests that reliance on AI technologies may not be enough for achieving maximum level of learning outcomes desired in the OTM students. Unequal access to AI technologies and internet facilities seemingly prevalent among OTM students in the South-west may also be a factor suppressing the expected influence of AI technologies on learning outcomes as reported by Sasikala and Rayichandran (2024).

Table 2: Regression results on influence of Academic Self-efficacy on Learning Outcomes of OTM students

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
(Constant)	.606	.105		5.767	.000
Academic Self-efficacy	.773	.037	.749	20.622	.000

$R^2=.562$; Adjusted $R=.560$; $p<0.05$ (Significant)

Dependent variable: Learning Outcomes

Source: Researcher's SPSS Analysis Output, 2025

Table 2 reveals the regression equation as $y = .606 + 0.773X_1$, where X_1 is students' academic self-efficacy. This shows that when all variables are held constant, academic self-efficacy will be at the intercept of .606. A unit increase in academic self-efficacy will result in 0.773 increase in learning outcomes of the OTM students. By implication, academic self-efficacy will have significant influence on learning outcomes of OTM students. R^2 of .562 also reveals that academic self-efficacy determine 0.56 or 56.2% of learning outcomes. Academic self-efficacy accounts for 56.2% of variation in learning outcomes among OTM students in public polytechnics in South-west, Nigeria. The table shows $\beta = .749$, indicating very high significant influence. Therefore, null hypothesis two which stated that there is no significant influence of academic self-efficacy on learning outcomes of OTM students in Southwest, Nigeria is not accepted.

The findings in Table 2 that academic self-efficacy have significant positive effect on learning outcomes among OTM students in South-west, Nigeria agree with the findings of Rorimpandey and Midun (2021) and Maggie, et al., (2020). The high level of predictive power of academic self-efficacy (56.2%) showed the prominence of students' self-efficacy for achieving desired learning outcomes. The implication is that the higher the level of OTM students' self-efficacy, the higher the levels of learning outcomes achieved. It could also be viewed that accessing and utilizing modern technologies like the AI tools for learning, OTM students need higher level of self-confidence.

Table 3: Regression results on combined influence of AI utilization and academic self-efficacy on Learning Outcomes of OTM students

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
(Constant)	.432	.148		2.914	.004
AI Utilization	.112	.068	.061	1.658	.098
Academic Self-efficacy	.760	.038	.737	19.920	.000

$R^2=.565$; Adjusted $R=.563$; $p<0.05$ (Significant); $F = 215.135$

Dependent variable: Learning Outcomes

Source: Researcher's SPSS Analysis Output (2025)

Data presented in Table 3 reveals significant combined influence of AI utilization (AIU) and academic self-efficacy (ACE) on learning outcomes among OTM students in South-west, Nigeria.

The regression equation obtained $y = .432 + .112X_1 + .760X_2$ where X_1 and X_2 are AIU and ACE respectively. The regression equation shows that, when all variables are held constant, AI utilization and academic self-efficacy will be at the intercept which is .432. A unit increase in AIU will cause .112 increase in learning outcomes, while a unit increase in ACE will result in .760 increase in learning outcomes of the OTM students. The regression result also shows R^2 of .565, indicating that both AIU and ASE jointly determine .565 or 56.5% of learning outcomes. They both account for 56.5% variation in learning outcomes of OTM students. However, academic self-efficacy significantly contribute higher ($\beta = .737$; $P < 0.05$); while AI utilization shows a low and insignificant contribution ($\beta = .061$; $P > 0.05$).

The findings indicate that although both AI utilization and academic self-efficacy jointly have significant influence on learning outcomes of the students, influence of AI utilization is low. This could imply that for AIU to have higher influence on learning outcomes, students' self-efficacy might be a necessary mediating variable as reported Wang et al., (2023).

Conclusion and Recommendations

The level of AI utilization of the OTM students has low contribution to their learning outcomes; the higher the level of utilization of AI technologies for learning, the better the attainment of learning outcomes. However, when academic self-efficacy is combined with utilization of AI technologies, the influence on learning outcomes will be highly significant among Office

Technology and Management students in the Polytechnics in Southwest, Nigeria.

It was recommended that OTM students and teachers should intensify efforts at boosting academic self-efficacy level of the students. OTM lecturers should engage students on the usage of AI tools in teaching and learning processes in order to boost the attainment of desired learning outcomes in the students. Also, educators and policy makers should develop interventions targeted at improving technological readiness of learners in the field of office management.

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INTEGRATION OF ARTIFICIAL INTELLIGENCE INTO THE TEACHING OF HOME ECONOMICS EDUCATION PRACTICAL SKILLS

Oluwaleyimu Olufunke Opeyemi (Ph.D)

Department of Technology and Vocational Education

University of Lagos, Lagos State, Nigeria

ooluwaleyimu@unilag.edu.ng

Abstract

This study investigated the integration of Artificial Intelligence into the teaching of Home Economics practical skills. Four research questions were formulated to guide the study. Relevant literatures were reviewed on the key indicators of the study. The study employed the use of descriptive survey research design on the population of 2000. A total of 20 Home Economics teachers were sampled using simple random sampling technique. The instrument used for data collection was a self-developed Likert scale questionnaire which was thoroughly scrutinized and confirmed valid through face and content validity method. The instrument confirmed reliable at .89 coefficient reliability. The data collected were collated and analyzed using descriptive statistics of frequency count and percentage for easy understanding and decision making. Hence, the study found that there are factors affecting the integration of Artificial Intelligence into the teaching of Home Economics practical skills in secondary schools. Also, that various prospects of integrating Artificial Intelligence into the teaching of Home Economics practical skills in secondary schools include: Practical skills and personal learning. Therefore, the study recommends that using AI as an instructional technology can be integrated into the teaching of Home Economics practical skills in schools. For effectiveness an average time can be allocated for the conduct of AI in secondary schools. To bridge the digital and access to technology, the government and the private sector can collaborate on strategies to secure reliable and affordable internet connectivity in schools.

Keywords: Artificial Intelligence, Home Economics, Integration, Practical skills, Teaching

Introduction

Home Economics is a dynamic field of study that draws on various disciplines, including pure sciences such as Biology and Physics; applied sciences such as Nutrition and Textiles Design; and social sciences such as Consumer Science and Resource Management (Uwameiye, 2015). This holistic approach equips individuals and families with the necessary skills to navigate the complexities of modern life and achieve a fulfilling standard of living. (Oluwagbemileke, 2019). The field's core focus lies in optimizing quality of life across individual, family, and community levels, encompassing aspects of well-being, resource management, and responsible citizenship (Achebe, 2013; Federal Republic of Nigeria, 2013). Home Economics education emphasizes understanding evolving family needs (Anyakoha, 2021) and therefore, empowers individuals to adapt to changing circumstances, such as advancement in the development and deployment of Information and Communication Technology (ICT) and Artificial Intelligence (AI).

According to Ejinkeonye and Usoroh (2016), Home Economics aims to improve the quality of life at individual, family, and societal levels. It has long been recognized as a vital subject, teaching students essential skills for life and living. Its role has also been well-recognized as an effective drive towards women's inclusion in significant sociopolitical activities such as voting (Renwick, 2015). With the advent of AI, there are even more opportunities to enhance the teaching experience and practical application of these skills. AI is being integrated into the teaching and

learning of home economics. From lesson delivery to assessment and grading, AI is revolutionizing the classroom experience.

The ability to customize learning outcomes is a key benefit of using AI into the teaching of Home Economics. According to Pane, Steiner, Baird, and Hamilton (2017), a paradigm change in traditional teaching approaches has occurred as a result of AI, which has emerged as a driving force for customizing the learning process. Essentially, customized learning is adjusting educational programs to meet the specific needs, learning preferences, and speeds of each individual student. Artificial intelligence algorithms are capable of analyzing the learning preferences, areas of strength, and limitations of individual students in order to customize exercises and instructional materials. To increase engagement and relevance, an AI-powered learning platform may, for instance, suggest recipes or budgeting techniques based on a student's preferences, dietary requirements, or financial objectives.

AI is not limited to the classroom; it also deals with the practical application of Home Economics skills. There have been several waves of emerging educational technologies over the past few decades. Today, AI takes the lead in the discourse of technological advancement (Bonk & Wiley, 2020) where it is transforming processes such as food preparation and nutrition, budgeting and financial planning, clothing and textile maintenance, home management and organization. It continues to streamline these tasks, empowering individuals to make informed decisions.

There have been several waves of emerging educational technologies over the past few decades, and now, there is Artificial Intelligence (Bonk & Wiley, 2020) and resources for all students. Ethical and privacy concerns surrounding AI use will also be addressed, emphasizing the importance of responsible implementation. The integration of AI in Home Economics education presents numerous opportunities for innovation and growth (Lu, 2019; Ma et al., 2020). Teachers are better able to comprehend the demands of their students (Fitria, 2021). Additionally, the students may easily adapt their learning to meet their requirements.

Statement of the Problem

The integration of Artificial Intelligence (AI) into the teaching of Home Economics practical skills may presents both opportunities and challenges in modern education. Home economics, which is a discipline that focused on essential life skills like cooking, nutrition, budgeting, and household management, stands to benefit greatly from AI technologies. However, several key issues must be addressed to ensure effective integration and maximize its potential impact on learning outcomes.

Firstly, one of the primary challenges is the accessibility and equitable distribution of AI resources. While AI-powered educational tools hold great promise for enhancing learning experiences, not all schools or communities have equal access to these technologies. Disparities in infrastructure, funding, technological literacy, and the lack of technological knowledge of teacher may exacerbate existing educational inequalities, leaving some students at a disadvantage in accessing AI-enhanced home economics instruction (Chiu & Chai, 2020).

Additionally, the ethical implications of AI integration in Home Economics education must be carefully considered. As AI systems collect and analyze vast amounts of student data, concerns regarding privacy, data security, and algorithm bias arise. teacher-student interaction by capturing and analyzing data from productive moments (Lamb & Premo, 2015). Without robust tracking of student progress, safeguards and regulations in place, there is a risk of unintended consequences, such as unauthorized data access or discriminatory outcomes, which could undermine trust in AI-powered learning platforms and jeopardize student well-being (Farhan et al., 2018).

Furthermore, the potential impact of AI on pedagogical practices and the role of educators is a critical concern. While AI can automate certain tasks, offer personalized learning experiences, and provide real-time feedback, it cannot replace the human element of teaching entirely (Alharbi & Al-Hoorie, 2020). The evolution of education towards digital education does not imply that people will need less teachers in the future (Dillenbourg, 2016). Teachers play a crucial role in fostering critical thinking, problem-solving skills, and socio-emotional development, which AI may struggle to replicate. Salomon (1996). Therefore, there is a need to strike a balance between leveraging AI to enhance instructional efficiency and preserving the unique contributions of human teachers in Home Economics education.

Moreover, the scalability and sustainability of AI integration in Home Economics teaching pose significant challenges. Implementing AI-powered solutions requires not only financial investments in technology infrastructure and teacher training but also ongoing support and maintenance to ensure effective utilization and long-term impact (Luckin & Cukurova, 2019; Luckin et al., 2016). Without adequate resources and institutional support, initiatives to integrate AI into Home Economics instruction may struggle to achieve sustainable outcomes and may even escalate existing resource disparities. It is on the backdrops that this study set to explore the integration of Artificial Intelligence into the teaching of Home Economics practical skills.

Purpose of the Study

The main purpose of the study is to investigate the Integration of artificial intelligence into the teaching of Home Economics practical skills. Specifically, the study

1. Identified the factors affecting the integration of artificial intelligence into the teaching of home economics practical exercise in secondary schools;
2. Determined the various prospects of integrating AI into home economics practical skills in secondary schools;
3. Discussed how AI can be integrated into home economics practical skills in secondary schools; and
4. Examined the appropriate and sufficient time allocation for the conduct of effective AI practical skills in senior secondary schools.

Research Questions

1. What are the factors affecting the integration of artificial intelligence into the teaching of home economics practical skills in secondary schools.
2. What are the various prospects of integrating artificial intelligence into the teaching of home economics practical skills in secondary schools.
3. How can artificial intelligence be integrated into the teaching of home economics practical skills in secondary schools.
4. What is the appropriate and sufficient time allocation for the conduct of effective AI in secondary schools.

Methodology

The design adopted in this study is the descriptive survey research design. This is because it involves the collection of opinions of people as regard the issue on discussion. This design allows the researcher in going to sample the opinions of the teachers' respondents on the integration of AI into home economics practical skills. The study was conducted in Kosofe local government area of Lagos State, Nigeria, which has an area of 81 km² (31 sq mi) and a population of 682,772. The population for the study was 682,772 and comprised 92 private and 38 public secondary schools, with each having one Home Economics teacher. Hence, the targeted population was 20 Home Economics teachers in Kosofe local government in Lagos state (Lagos State schools online,

2024). There was no sampling involved because the target population size covers the entire 20 teachers of Home Economics who were respondents in the study.

The instrument that was used in carrying out this study was the questionnaire and interview. A 20-item structured questionnaire was design to elicit responses from the respondents. The questionnaire was divided into two sections. The section A consisted of items structured to elicit information about the demographic data of the respondent while section B was designed to elicit data on the research questions. The questionnaire was designed in 4-point rating scale which includes: Strongly Agree, Agree, Disagree and Strongly Disagree. An interview guide was designed and sent to the respondents to familiarize them with the content of the study. The reliability of the instrument was determined by administering questionnaires. The instrument was administered to twenty teachers in Kosofe Local Government area. The results were computed and analyzed using the SPSS 25 and a reliability coefficient of .89 was obtained.

The copies of the questionnaire were directly and personally administered to the selected respondents by the researcher. The data collected were analyzed using frequency count and percentage for the bio-data while the research questions were analyzed using descriptive statistical tools of mean and standard deviation to describe the level of agreement and disagreement of the respondents.

Results

Research Questions One

What are the factors affecting the integration of artificial intelligence into the teaching of home economics practical skills in secondary schools.

Table 1:

S/N	STATEMENT	SA	A	D	SD	TOTAL
1.	AI tools can enhance the understanding of home economics concepts among students.	6 (30.0)	9 (45.0)	2 (10.0)	3 (15.0)	20 (100.0)
2.	I believe integrating AI will improve learning outcomes in home economics.	12 (60.0)	7 (35.0)	0 (0.0)	1 (5.0)	20 (100.0)
3.	Insufficient training opportunities for teachers on how to effectively use AI in teaching home economics.	7 (35.0)	12 (60.0)	1 (5.0)	0 (0)	20 (100.0)
4.	Lack of access to appropriate AI technologies in schools is a barrier.	9 (45.0)	9 (45.0)	2 (10.0)	20 (100.0)	20 (100.0)
5.	Integrating AI technologies is beneficial for preparing students for future technological advancements.	7 (35.0)	12 (60.0)	0 (0)	1 (5.0)	20 (100.0)
6.	Parents' and educators' attitudes toward AI in education and its influence on student learning experiences.	3 (15.0)	14 (70.0)	2 (10.0)	1 (5.0)	20 (100.0)
7.	Access to smart kitchens, automated sewing machines, and other AI-enhanced tools for practical learning.	11 (55.0)	7 (35.0)	1 (5.0)	1 (5.0)	20 (100.0)
8.	Practical applications, improvements, and obstacles in hands-on learning with AI integration.	11 (55.0)	6 (30.0)	3 (15.0)	0 (0)	20 (100.0)
9.	The potential of AI to change hands-on learning experiences, such as cooking, sewing, and budgeting activities.	9 (45.0)	10 (50.0)	1 (5.0)	0 (0)	20 (100.0)
10.	Availability of technology, internet connectivity, and necessary hardware in educational settings.	10 (50.0)	6 (30.0)	4 (20.0)	0 (0)	20 (100.0)

Table one reveals that (30.0%) and (45.0%) respondents strongly agreed and agreed that AI tools can enhance the understanding of Home Economics concepts among students while others disagreed. 60.0% and 35.0% also jointly agreed that they believe integrating AI will improve learning outcomes in Home Economics while others disagreed. 35.0% and 60.0% also strongly agreed and agreed that insufficient training opportunities for teachers on how to effectively use

AI in teaching Home Economics while others disagreed. 45.0% and 45.0% also jointly agreed Lack of access to appropriate AI technologies in schools is a barrier while others disagreed. 15.0% and 70.0% strongly agreed and agreed that Integrating AI technologies is beneficial for preparing students for future technological advancements while others disagree Access to smart kitchens, automated sewing machines, and other AI-enhanced tools for practical learning. 15.0% and 70.0% strongly agreed and agreed that parents' and educators' attitudes toward AI in education and its influence on student learning experiences while others disagreed. 55.0% and 35% strongly agreed and agreed that access to smart kitchens, automated sewing machines, and other AI-enhanced tools for practical learning while others disagreed. 55.0% and 30.0% strongly agreed and agreed that Practical applications, improvements, and obstacles in hands-on learning with AI integration while others disagreed. 45.0% and 50.0% strongly agreed and agreed the potential of AI to change hands-on learning experiences, such as cooking, sewing, and budgeting activities others disagreed. While 50.0% and 30.0% strongly agreed and agreed that availability of technology, internet connectivity, and necessary hardware in educational settings.

Research Questions Two

What are the various prospects of integrating artificial intelligence into the teaching of home economics practical exercise in secondary schools.

Table 2: Prospects of integrating artificial intelligence

S/N	Statement	SA	A	D	SD	Total
1	AI can provide personalized learning experiences for students.	3 (15.0)	14 (70.0)	2 (10.0)	1 (5.0)	20 (100.0)
2	AI can help in assessing students' practical skills more accurately.	11 (55.0)	7 (35.0)	1 (5.0)	1 (5.0)	20 (100.0)
3	The cost of implementing AI in schools is a major concern.	11 (55.0)	6 (30.0)	3 (15.0)	0 (0.0)	20 (100.0)
4	AI technology is reliable for use in educational settings.	9 (45.0)	10 (50.0)	1 (5.0)	0 (0.0)	20 (100.0)
5	AI can support students with special needs in Home Economics practical.	10 (50.0)	6 (30.0)	4 (20.0)	0 (0.0)	20 (100.0)
6	The integration of AI into Home Economics education is a feasible and practical goal for the near future.	9 (45.0)	3 (15.0)	6 (30.0)	2 (10.0)	20 (100.0)
7	There are sufficient training programmes available to equip Home Economics teachers with the skills to use AI effectively.	0 (0.0)	1 (5.0)	12 (60.0)	7 (35.0)	20 (100.0)
8	AI applications will make the teaching of Home Economics more engaging for students.	12 (60.0)	7 (35.0)	0 (0.0)	1 (5.0)	20 (100.0)
9	The use of AI in Home Economics will reduce the amount of time teachers spend on administrative tasks, allowing more focus on instruction.	9 (45.0)	9 (45.0)	0 (0.0)	2 (10.0)	20 (100.0)
10	AI has the potential to personalize Home Economics lessons to meet individual student learning needs.	12 (60.0)	7 (35.0)	1 (5.0)	0 (0.0)	20 (100.0)

Table two revealed that (15.0%) and (70.0%) respondent strongly agreed and agreed AI can provide personalized learning experiences for students while others disagreed. 55.0% and 35.0% jointly agreed that AI can help in assessing students' practical skills more accurately while others disagreed. 55.0% and 30.0% strongly agreed and agreed the cost of implementing AI in schools is a major concern while others disagreed. 45.0% and 50.0% strongly agreed and disagreed AI technology is reliable for use in educational settings whereas others disagreed. 50.0% and 30.0% agreed AI can support students with special needs in home economics practical while others disagreed. 45.0% and 15.0% strongly agreed and agreed the integration of AI into Home Economics education is a feasible and practical goal for the near future while others disagreed. 60.0% and 35.0% disagreed and strongly disagreed that there are sufficient training programs available to equip home economics teachers with the skills to use AI effectively while others agreed and disagreed. 60.0% and 35.0% strongly agreed and agreed that AI applications will make the teaching of home economics more engaging for students while others disagreed. 45.0% and 45.0% strongly agreed and agreed that the use of AI in Home Economics will reduce the amount of time teachers spend on administrative tasks, allowing more focus on instruction while others disagreed. Whereas 60.0% and 35.0% strongly agreed and disagreed that AI has the potential to personalize Home Economics lessons to meet individual student learning needs.

Research Questions Three

How can AI be integrated into artificial intelligence be integrated into the teaching of home economics practical skills in secondary schools.

Table 3:

S/N	Statement	SA	A	D	Total
1	The use of AI-enhanced instructional technology will make Home Economics more engaging for students.	10 (50.0)	4 (20.0)	3 (15.0)	20 (100.0)
2	The use of AI and instructional technology may reduce the workload of Home Economics teachers.	12 (60.0)	6 (30.0)	0 (0.0)	20 (100.0)
3	AI-enhanced instructional technology is reliable for use in educational settings.	6 (30.0)	10 (50.0)	3 (15.0)	20 (100.0)
4	The integration of AI and instructional technology in Home Economics will require substantial changes to the curriculum.	10 (50.0)	8 (40.0)	1 (5.0)	20 (100.0)
5	AI and instructional technology can enhance collaboration among students during practical exercises.	8 (40.0)	9 (45.0)	3 (15.0)	20 (100.0)
6	AI can help reduce the time spent on lesson preparation and grading, allowing Home Economics teachers to focus more on student interaction.	10 (50.0)	11 (55.0)	1 (5.0)	20 (100.0)
7	The cost of implementing AI instructional technologies in Home Economics classrooms may be a significant barrier to adoption.	10 (50.0)	6 (30.0)	4 (20.0)	20 (100.0)
8	The integration of AI in instructional technology will help bridge the gap between traditional teaching methods and modern technological advancements in Home Economics.	12 (60.0)	5 (25.0)	3 (15.0)	20 (100.0)
9	Teachers are confident in their ability to integrate AI-powered instructional technology into Home Economics lessons.	1 (5.0)	8 (40.0)	11 (55.0)	20 (100.0)
10	The use of AI in instructional technology can make Home Economics more interactive and hands-on for students.	9 (45.0)	11 (55.0)	0 (0.0)	20 (100.0)

Table three revealed that (50.0%) and (20.0%) respondent jointly agreed the use of AI-enhanced instructional technology will make home economics more engaging for students while others disagreed. 60.0% and 30.0% strongly agreed and disagreed the use of AI and instructional technology may reduce the workload of home economics teachers while others disagreed. 30.0%

and 50.0% strongly agreed and disagreed AI-enhanced instructional technology is reliable for use in educational settings whereas others disagreed. 50.0% and 40.0% strongly agreed and agreed the integration of AI and instructional technology in Home Economics will require substantial changes to the curriculum while others disagreed. 40.0% and 55.0% jointly agreed AI and instructional technology can enhance collaboration among students during practical exercise whereas others disagreed. 50.0% and 30.0% strongly agreed and agreed that AI can help reduce the time spent on lesson preparation and grading, allowing Home Economics teachers to focus more on student interaction whereas other disagreed. 50.0% and 25.0% strongly agreed and agreed that the cost of implementing AI instructional technologies in home economics classrooms may be a significant barrier to adoption whereas others disagreed. 60.0% and 40.0% strongly agreed and agreed that the integration of AI in instructional technology will help bridge the gap between traditional teaching methods and modern technological advancements in home economics whereas others disagreed. 40.0% and 40.0% strongly disagreed and disagreed that teachers are confident in their ability to integrate AI-powered instructional technology into home economics lessons whereas others agreed. 45.0% and 45.0% strongly agreed and agreed that the use of AI in instructional technology can make home economics more interactive and hands-on for students whereas other disagreed.

Research Questions Four

What is the appropriate and sufficient time allocation for the conduct of effective AI in senior secondary schools.

Table 4: Appropriate and sufficient time allocation for the conduct of effective AI

S/N	Statement	SA	A	D	SD	Total
1	The current time allocated for AI education is sufficient for effective learning.	7 (35.0)	11 (55.0)	2 (10.0)	0 (0.0)	20 (100.0)
2	Increasing time allocation for AI education would improve students' understanding of AI concepts.	7 (35.0)	8 (40.0)	5 (25.0)	0 (0.0)	20 (100.0)
3	AI topics should be integrated into other subjects to maximize time efficiency.	10 (50.0)	8 (40.0)	2 (10.0)	0 (0.0)	20 (100.0)
4	There is a need for more frequent AI classes throughout the school year.	8 (40.0)	8 (40.0)	3 (15.0)	1 (5.0)	20 (100.0)
5	The time dedicated to AI education should be reviewed and adjusted regularly.	12 (60.0)	6 (30.0)	1 (5.0)	1 (5.0)	20 (100.0)
6	More instructional time is needed to effectively implement AI tools in practical Home Economics skills.	10 (50.0)	4 (20.0)	3 (15.0)	3 (15.0)	20 (100.0)
7	Teachers need additional time for lesson planning to incorporate AI tools into Home Economics teaching.	12 (60.0)	6 (30.0)	0 (0.0)	2 (10.0)	20 (100.0)
8	Teachers are provided with adequate professional development time to learn how to integrate AI into Home Economics effectively.	3 (15.0)	1 (5.0)	6 (30.0)	10 (50.0)	20 (100.0)
9	Without sufficient time allocation, the integration of AI into Home Economics will not yield the desired educational outcomes.	10 (50.0)	8 (40.0)	2 (10.0)	0 (0.0)	20 (100.0)
10	The current time allocated for AI integration into Home Economics teaching is adequate for both theory and practical applications.	2 (10.0)	1 (5.0)	6 (30.0)	11 (55.0)	20 (100.0)

Table four revealed that (35.0%) and (55.0%) respondent jointly agreed the current time allocated for AI education is sufficient for effective learning while others disagreed. 35.0% and 40.0% strongly agreed and agreed increasing time allocation for AI education would improve students' understanding of AI concepts whereas others disagreed. 50.0% and 40.0% strongly agreed and

agreed AI topics should be integrated into other subjects to maximize time efficiency while others disagreed. 40.0% and 40.0% strongly agreed and disagreed there is a need for more frequent AI classes throughout the school year while others disagreed. 60.0% and 30.0% jointly agreed the time dedicated to AI education should be reviewed and adjusted regularly while others rejected. 50.0% and 20.0% strongly agreed and agreed that more instructional time is needed to effectively implement AI tools in practical Home Economics practical skills while others disagreed. 60.0% and 30.0% strongly agreed and agreed that Teachers need additional time for lesson planning to incorporate AI tools into Home Economics practical teaching, while others disagreed. 30.0% and 50.0% strongly disagreed and disagreed that teachers are provided with adequate professional development time to learn how to integrate AI into home economics effectively while others agreed. 50.0% and 40% strongly agreed and agreed that without sufficient time allocation, the integration of AI into Home Economics will not yield the desired educational outcomes while others disagreed. 50.0% and 30.0% strongly disagreed and disagreed that the current time allocated for AI integration into Home Economics teaching is adequate for both theory and practical applications while others agreed.

Discussion of the Findings

Based on the findings of this study, it was deduced that integration of artificial intelligence into the teaching of home economics practical skills. In relation to the research questions one, it is evident that integration of artificial intelligence into the teaching of home economics practical skills influence secondary school student positively, Influence student proficiency, AI will improve learning outcomes in home economics practicals as indicated that insufficient training opportunities and lack of appropriate technologies will be a barriers for positive growth Oluwagbemileke, F. B. (2019). Integrating AI technologies is beneficial for preparing students for future technologies advancements.

From research question two, based on the respondent it was observed that AI can provide personalized learning for student and also help in assessing student practical skills more accurate. The cost of implementing AI in schools is a major concern Chiu, T. K., & Chai, C. S. (2020). AI technology is reliable for educational setting and also support student with special needs in home economics practical. Research question three established that the use of AI-enhanced instructional technology will make home economics more engaging for student and reduce the work load of home economics teachers. Uwameiye, B. E. (2015). The integration of AI and instructional technology in home economics will require substantial changes to the curriculum. It also enhances collaboration among students during practical classes.

Furthermore, research question four maintained that the timing allocated for AI is sufficient for effective learning and increasing time allocation would improve students understanding of AI concept. AI should also be integrated in other subject to maximize time efficiency Renwick, K. (2015). There is need for more frequent AI through the school years and timing should be adjusted regularly.

Conclusion

Integration of artificial intelligence into the teaching of Home Economics practical skills. AI is a key factor that can enhance the teaching and learning of Home Economics subject in senior secondary schools. Home Economics as a subject to some students is very stressful. It was discovered that the use of Artificial Intelligence in the teaching of Home Economics practical skills enhances students' comprehension and performance in the subject.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. To foster a supportive environment for AI integration and continuous improvement, school administrators should encourage collaboration between home economics teachers, ICT/AI specialists, and educational content developers. This collaboration can lead to the sharing of best practices, the creation of innovative ICT-based learning activities, and a stronger support system for educators.
2. Home economics teachers should be empowered with the skills to leverage technology effectively, the Ministry of Education should invest in comprehensive training programs focused on artificial intelligent (AI) integration and provide ongoing support through workshops, mentoring programs, and online resources.
3. To bridge the digital and access to technology, the government and the private sector can collaborate on strategies to secure reliable and affordable internet connectivity in schools. Additionally, schools can explore public-private partnerships or innovative financing models to acquire and maintain essential ICT equipment like computers, tablets, and projectors.
4. To enhance student engagement, educational institutions and content developers should work together to create a robust ecosystem for high quality digital learning materials. These resources should be available in local languages, reflect the local culture, and cater to diverse learning styles.
5. To explore the potential of AI in enhancing the learning experience, the Ministry of Education and educational research institutions can investigate the integration of artificial intelligence (AI) in Home Economics education. This could involve implementing AI-powered intelligent tutoring systems for personalized feedback and developing virtual reality simulations for immersive practical experience

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ARTIFICIAL INTELLIGENCE IN BUSINESS EDUCATION: A REVIEW

Dosunmu, Margaret Moronke (Ph.D) FNIM

Department of Educational Management and Business Studies

Faculty of Education

Olabisi Onabanjo University, Ago-Iwoye.

dosunmu.margaret@oouagoiwoye.edu.ng.

Abstract

Artificial Intelligence (AI) has changed the narratives in peoples' lives by making life easier and comfortable through technological advancements. This paper attempts to review artificial intelligence in Business Education. It further attempts to look at the benefits and challenges of AI; the application arrears of AI to Business Education like students' performance prediction; automated grading; learning analytics; Chatbots and Virtual Assistant; Campus safety and others were further reviewed.

Keywords: Artificial Intelligence and Business Education

Introduction

Before the advent of technologies and computers, students engaged in learning mechanically through the application of natural human efforts of the teachers. According to Naser (2008), traditional education is not able to deal with varied learning styles and degrees of preparation. Students work with individual teachers who may not be able to address their needs in full, which often leads to academic deficiency. Computer and information technology communication have evolved thereby leading to the development of artificial intelligence. The advancement, proliferation of technology and the introduction of computers have made it easier for instructors/teachers to dispense their duties more effectively and efficiently.

Artificial Intelligence in Education makes education more technological in automating grading. AI chatbots communicates with students as a teaching assistants. AI algorithms analyzes students' performance and tailored educational content towards students' needs. Automation of administrative task is possible; students can study from anywhere in the world, having access to teachers and teachers can provide instructions effectively. The innovative changes the world is experiencing now have now shown that the future is unpredictable as it relates to education, knowledge, skills, competencies and technology as they are seen as the bedrock of the economics, social and political growth of a nation. Artificial intelligence and machine learning are designed to revolutionize the educational systems through the provision of personalized learning experiences for teachers and students – teachers will have access to tools that will adapt to the learning pace of the students, generate feedback and significantly enhance students' performance.

Business education is the type of education that assists individuals to acquire skills which they can apply to solve problems in business and office occupations. Its primary aim is the training of future teachers, business managers and entrepreneurs. Nwaugburu and Eneogwe (2019) opined that Business education aims to prepare and equip students with the required skills and competencies needed to increase their chances of finding jobs across the board after schooling. As such, Business education equips the students with the knowledge needed to create their own employment opportunities. Anyaeneh and Nzegwu (2017) supported this concept by stating that it prepares students for an occupation in business or a business related fields or in teaching career in academics. The implementation and introduction of Artificial Intelligence in Business education have great results to increase the efficiency and effectiveness of learning. The

technology helps teachers to prepare, present learning materials, provides feedback to students and automate several administrative tasks of the learning process. It is imperative to note the teachers' role is still crucial in directing and accompanying students' learning processes through artificial intelligence.

Concept of Artificial Intelligence

Kaplan and Haenlein (2019) define Artificial Intelligence (AI) as systems to interpret external data and to learn and use those learnings to achieve a specific goal or task via adaption; systems are created to perform specific tasks on their own. The system can achieve near human performance in a wide range of activities. AI is the development of computer systems that performs tasks that require human intelligence and the system can learn from data experiences and interactions, enabling swift performance, improvement and adaption to new situation. AI is able to identify and resolve problems using creative and innovative approaches. It can interpret and understand data from sensors, images, speech and text; enabling a better understanding of the world around us. Baker and Smith (2019) provide a definition of AI as “computers which perform cognitive tasks associated with human minds, particularly learning and problem-solving”. AI is not a single technology but an umbrella term used for a range of technologies and methods, such as machine learning, data mining, neural networks, algorithm and natural language processing. AI and machine learning are often used interchangeably. Popenici and Kerr (2017) define machine learning as a subset of artificial intelligence which includes software that recognizes patterns, makes predictions and applies new discovered patterns to situations that are not included or covered by their initial design.

Berglund et. al. (2020) opine that AI can comprehend and generate human languages; enabling them to communicate with humans. They add that it uses algorithms to process data, learn from experiences and the system relies on high-quality data to learn, improve and make accurate decisions. Berglund, Bousfiha and Mansoori (2020) further asserted that the system requires significant computing power to process large amounts of data and perform complex tasks. Baker and Smith (2019) highlighted the three different perspectives of educational AI: a) teacher-facing, b) learner-facing and c) system-facing. The teacher-facing system is used by teachers for support and to reduce their workload through automation of administrative tasks, assessment, feedback and plagiarism check; through this approach the teacher can provide support and guidance where needed. The learner-facing method is the use of software for students to learn a subject matter through adaptive and personalized learning management systems. The system-facing method are tools used to provide information for teachers, managers and administrators at the institutional level, for example to monitor performance and attrition patterns across departments.

Advantages of Artificial Intelligence

Decisions reached through AI are facts, not emotions; as emotions often affect decision either negatively or positively; repetitive tasks are easily done faster and accurately; success rate in dealing with task is high; AI can relate with customers by answering questions; AI makes task faster, easier and smoother with less stress. Difficult work can be done in short period; keeping of large amount of data and file is possible (Kanran, 2024).

Disadvantages of Artificial Intelligence (AI)

Unemployment – AI reduces human needs; leads to human laziness; costly; dependence on data availability and data quality; lacks emotional intelligence – no emotions or heart; AI cannot work as a team – no bonding as human, the attribute necessary to work as a team; no privacy and security; difficulty in understanding the concept. Human beings are creative on the use of AI, AI is not creative on its own; AI leads to dependency on technology; it requires a good data reliability (Kanran, 2024).

Application Arrears of Artificial Intelligence (AI) in Business Education

AI can be applied in Business Education in the following ways:

Intelligence Tutoring System: This is a personalized computer-based learning system which allows feedback from the students. It is a computer system that imitates human tutors and aims to provide immediate and customized instructions or feedback to learners, usually without requiring intervention from a human teacher. According to Alkhatlan and Kalita (2018), intelligence tutoring systems is a computer-based educational system which has independent data basis or knowledge basis for educational content in addition to teaching strategies. It gives an insight into the learner's ability to understand topics and identify the strengths and weaknesses which will lead to further learning and learning dynamic process. LKaraci et. al. (2018) argued that students who utilized intelligence tutoring system performed better academically than their counterparts who did not make use of the system, but concentrated on the conventional method of education. Intelligent tutoring systems have also been used not only in the educational sectors but also in the fields of Engineering, Language, Mathematics, Medicine, Information Technology etc.

In recent times, the application of AI technology, especially machine learning has developed in educational institutions and people have been increasingly reliant on its applications and software in a variety of fields (Chichekian & Benteux, 2022). Tuomi (2018) asserted that intelligent tutoring offers effective and efficient learning experiences, making education more accessible and engaging and it supplements traditional teaching methods and prepares the students for standardized tests as well as providing students' tailored support for diverse learners.

Personalized Learning (PL): This is an educational approach which aims at customizing learning for each student's strengths, needs, skills and interest. It has a learning plan which focuses on each learner - on what they know and how they can learn best. AI-powered tutoring systems can adapt to each student's pace and learning style. Platforms like Chat GPT or Grammarly can assist with writing, grammar and communication tasks. Personalized learning is designed to see each learner as a distinct individual who is capable to learn at his/her pace. The instruction received by the learner must be tailored towards their unique needs, interests and abilities. PL allows for individual learning projects which allow students to take initiative and be active participants in their own learning. Students receive guidance from teachers who use data-based teaching methods. Hopkins (2010) defined personalized learning as reimagining the education system around the learning needs and talents of young people, which is the basis for schools becoming great. It is a high quality teaching method that is responsive to the different ways students achieve their best. It is a system that responds to individual pupils by creating an education path that takes account of their needs, interests and aspirations that will not only generate excellence but will also make a strong contribution to equity and social justice. PL provides students with a unique learning pathway, allowing them to learn at their own pace and to focus on their strengths and weaknesses.

Students' Performance Prediction: Students' performance prediction is indexed by factors such as self-esteem, academic motivation, anxiety, sociological factors, socio-economics factors, status, ethnicity, religiosity and mother tongue. All these factors are linked to the academic performance of the students. The use of AI algorithms which use data like prior academic achievement will predict whether a student will be successful in academics or not. The traditional method adopted by teachers to monitor the students through continuous assessment does not give the early insight into the support needed by the underperforming students, (Silberglitt et. al., 2015).

Hashim et. al. (2020) asserted that some institutions of learning are now using sophisticated systems that can collect and analyze data on students' academic activities to improve learning, support students' success and develop self-regulated learning skills. Yagci (2022) opined that learning management system (LMS) are increasingly leveraging machines to evaluate student

interactions and engagement, highlighting areas for improvement and offering insights into their learning behavior. The technologies enhance personalized education and enable educators to identify and support students more efficiently. As far as the machine learning is good enough, the major challenge is the data fragmentation and inconsistency which may affect the performance of the models. The issue of data privacy too is a challenge as most educational institutions do not ensure that students' data adheres to strict privacy laws and regulations (Saura, et. al., 2022). To overcome the mentioned challenges, there should be inclusion of government policies, creation of transparent interpretable machine learning models and continuous training for the teachers.

Automated Grading: Automated grading, according to Jain et. al. (2023), is a technical solution used by educational institutions for grading. Advanced machine learning and AI technologies are used to evaluate students' work. The technology saves time in evaluating the students, provides uniformity in grading and improves overall learning experiences. The process is automated and establishes a standardized approach that minimizes biases and discrepancies. The automated grading system compliments the traditional grading approaches as it has the potential to improve the efficiency and effectiveness of assessment practices in educational systems.

Advantages of Automated Grading System

1. Efficiency – time saving
2. Consistency – standardization devoid of biases and inaccuracies
3. Immediate Feedback
4. Scalability – handling of large volume of tasks
5. Data analysis – data generated can be used for improvement of teaching methods
6. Reduced workload
7. Objective evaluation – openness in grading
8. Adaptability – suits various types of tasks

Disadvantages of Automated Grading System

1. Inaccessibility to proper internet
2. User must have the knowledge of computer use
3. Adaptability of the teachers and learners to utilize the technology

Learning Analytics (La): Learning analytics in education is about the collection and analysis of data of a learner. This is needed for the purpose of understanding and improving on their learning outcomes. Osakwe et. al. (2022) described learning analytics as the measurement, collection, analysis, storage and reporting of all student-related data. LA covers a wide aspect of Psychology, Education and Computer Science. Sclater (2016) opined that LA gathers and analyses students' data through a pattern that will enhance their learning process and lead to better performance.

Benefits of Learning Analytics

1. Predicting and optimizing students' performance
2. Decision-making and content/lecture delivery
3. For students' retention and progress
4. For personalized learning and accountability

The major challenge of LA is the inability to capture, analyse, store and use data to achieve better performance.

Chatbots And Virtual Assistants: Chatbots are designed to handle simple repetitive tasks while virtual assistants manage complex personalized interactions. Both technologies help individuals and organisations to automate repetitive tasks, thereby cutting costs and achieving efficiency. Chatbots and Virtual Assistants address the problem of complexities of information, science and

knowledge management. It provides real-time assistance, routine tasks automation, retrieval of information, facilitating initiative and generally enhancing the overall efficiency of the organization (Hashim, 2024). Exposure to tools like Siri, Alexia and Google Assistant helps the students to understand and leverage on virtual support systems. Learning how to train or manage AI scheduling tools, likex.ai or Clara prepares the students for tech-savvy office roles.

Benefits of Chatbots and Virtual Assistant System

1. Knowledge dissemination and retrieval
2. Personalized responses
3. Enhancing user' efficiency and experiences
4. Handles large amount of data and giving accurate information

Challenges

1. Ethical considerations and privacy issues
2. Ethical dilemmas as it affects decision making and information disclosure (Aslam, 2023)

Campus Safety

A safe environment for learning allows students to excel without fear or concerns. The safety of student is paramount because it is part of requirements for pursuit of academic excellence. The campus security solutions to make the campus safe and secure:

- a. Video surveillance and analytics
- b. Access control and lockdown systems
- c. Intercoms and panic buttons
- d. Emergency and security management platforms
- e. Metal detectors connected to video management platforms
- f. Gunshot detection and audio analytics
- g. Bulletproof doors

Recruitment And Admission: Reilly (2018) pointed out that recruitment and admission is one of the University' functions that have undergone technological innovation and transformation. Most institutions have adopted AI software and solutions to deal with the situations, as AI is a catalyst for innovation and development. Recruitment and admission process is working to select candidates for admission into the higher institution of learning (Lindmark & Onnevik, 2011). It is a process of selecting qualified candidates for admission. Crawshaw et. al. (2014) asserted that technology is shaping the way people work and adopting the right technology will promote effective and efficient processes which is crucial for the organization's survival. Generative AI tools such as ChatGPT and educational chatbots can be used by applicants for crafting admission essays, automating essay scoring and guiding students through the application process.

Generative and and Delilah ai

This is an interface which enables users to query and receive prompts like human-like responses generated by the AI. It provides accurate or up-to-date information due to its general purpose nature. It is a useful tool for brainstorming and generating contents for institutions. AI predictive models can be used to generate, evaluate and understand the overall accuracy and effectiveness of the primary factors in admission decisions and variations within different groups. Machine learning algorithms can also help institutions for better admission criteria and their impact in the admission process.

AUTOMATED TRAINING SIMULATIONS – this stimulates real-world office scenarios using AI, for example handling emails, scheduling, meetings and document drafting). The use of AI chatbots will simulate difficult customer interaction tasks.

SPEECH-TO-TEXT AND TRANSCRIPTION TOOL - tools like offer.ai or Dragon allow naturally speaking transcription into text. Naturally speaking allows students to practice voice typing, transcription and summarization of what is learnt.

DOCUMENT MANAGEMENT AND DATA ENTRY – AI can teach smart data classification, archiving and retrieval using system like Microsoft SharePoint with AI enhancements. This allows students to supervise and audit AI generated records.

BENEFITS OF ARTIFICIAL INTELLIGENCE IN EDUCATION

1. Enhanced individualized learning – platforms like DreamBox and Smart sparrow are used to analyze students' responses thereby enabling them to master concepts at their own pace
2. Automated Administrative tasks – this is used to reduce the teachers' workload. Gradescope is a tool for consistent and objective grading of assignments
3. More engaged learners – this a platform for interactive and engaging learners
4. Improved accessibility – the AI technology assists physically challenged students for effective learning. Notta software transcribes oral words into text for the impaired students.
5. Actionable insights – Knewton Alta helps the teachers to track the students' performance by identifying learning gaps and adjusting the instructional strategies.
6. Efficient classroom management – AI assists teachers in managing classroom behavior and engagement
7. Security and assessment integrity – tools like Turnitin helps in checking for originality of students' works.
8. Continuous lifelong learning and professional development – teachers are able to develop themselves through recommended personalized resources and courses. Edthena platform provides learning paths on career goals and teaching need.
9. AI platforms are used for large data and provide learning experiences through accessibility and consistency in education.

Challenges of Artificial Intelligence in Business Education

AI is a tool that can be used to improve the efficiency and effectiveness of various processes which include curriculum design, administrative tasks and aiding students' learning. Despite these benefits, the challenges of AI application to Business education are:

- **Data Privacy and Security Breaches** – AI requires large amounts of data for personal information on students, staff and the higher institution of learning; such data are prone to cyber-attacks and some other security breaches. Vital and sensitive information can be exposed to hackers (Kumar, 2019).
- **Faculty Training** – many teachers may not possess the knowledge, skills and experience to teach artificial intelligence courses. The applicability of AI to the teaching of Business education may be cumbersome thereby making its integration into the curricula difficult. Oguejiodor and Ezeabasile (2017) asserted that teachers may not have the required time and resources to devote to artificial intelligence as they may be saddled with other administrative functions which require some level of commitment.
- **Lack of Transparency and Interpretation** – as a result of AI algorithms being complex and difficult to understand, it makes the evaluation of its effectiveness and identification of potential errors more tasking. This challenge can lead to teachers making uninformed decisions which could mar the institution's performance.
- **Dehumanization and Loss of Personal Touch** – the use of AI reduces the human interaction with students which leads to less satisfying and engaging educational experience for them. AI may also lead to over-automation, diminishing human skills and judgement. Essential skills like empathy, innovation, communication and interpersonal

- exchanges are neglected. The ineffective integration of AI into learning leads to inadequate AI education, limited AI adoption, misconception, fear and skill widening gap.
- **Ethical Consideration** – AI relies on some levels of personal information which may lead to invasion into data protection and privacy.
 - **Required AI Resources:** – Most institutions are unable to afford AI software, hardware and tools, making the institutions lacking in infrastructure such as high performance computing, internet bandwidth and data storage. Nwosu (2019) posited that some institutions rely on cloud services, which are prone to outage and data privacy invasion.
 - **Students' Preparation** – students may not understand the concepts and technologies of AI, as such not possessing the required technical skills such as data analysis and programming. This is supported by Nwanewezi (2018) who posited that students need skills like problem-solving and critical thinking to apply AI effectively into learning.
 - **Meeting Industry Needs** – balancing the academic curriculum with the industry' needs and timeliness can be a challenge as academic goals must meet with industry's requirements for employability.
 - **Traditional Teaching Method** – the traditional method relies solely on lecture methods and note taking, while AI integrated method requires special skills like problem-solving, critical thinking and practical applicability of the theoretical knowledge to tackle challenges at work.
 - Non-availability of stable and fast internet access throughout the country.

Solutions to Challenges of AI to Business Education

- Higher institutions of learning must exploit the potential of AI in increasing personalized learning and development of adaptive curricula. They should incorporate and develop AI literacy programs into basic curricula enabling students to understand the concepts of AI and applications from the pre-school level.
- Teachers need training and upskilling to stay connected to the wide-ranging latest developments and cutting edge advancements in AI.
- Creation of learning systems which use AI to analyze students' data and tailored towards individual's needs.
- Contents should be developed to suit learner' needs through integration of AI into the curricula. Regularly update and review curricular to reflect rapid evolution in the industry needs.
- Balance AI with human skills by emphasizing the complimentary role of major skills into teaching and learning.
- Collaboration between the government, technology companies and educational institutions for investment in technology infrastructure and training of teacher on AI must be implemented.
- Development of policies that support the implementation and development of AI in education and protecting students' data privacy.

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VOCATIONAL EDUCATION FUNDING ACCOUNTABILITY AND PERIOD POVERTY- INTERCONNECTING UNSDGS 1, 3, 4 AND 5 TO ACHIEVE ZERO POVERTY BY 2030

¹Shakirat Adepeju Babatunde, ²Ngozi E. Uzoka & ³Cliff Ntimbwa Manongi

¹Lagos State University of Science and Technology,
College of Applied Social Sciences,
Department of Accounting,
Isolo Campus, Lagos, Nigeria.

²University of Lagos, Faculty of Education,
Department of Educational Management, Akoka, Lagos, Nigeria.

³College of Business Education,
Department of Business Studies with Education,
Dar es Salam, Tanzania
babatunde.sa@lasustech.edu.ng

Abstract

This study discusses educational funding, period poverty and actualisation of sustainable development goals. It utilises ex-post facto research design covering data that spans 25 years from 2000 to 2024. It targets relevant data on educational funding and women's poverty constructs. It addresses a research question. Descriptive and inferential statistical analysis are performed on the data. Results show that the educational budget has no significant effect on women not in the labour force participation rate (WNLFP) and maternal mortality rate for Nigeria (MMRNI). This study identifies that the actualisation of UNSDGS 1, 3, 4 and 5 requires explicitly policymakers better understanding of the need to focus on women; although it is almost too late for the 2030 timeline, it can still materialise. Hence, this study argues that the need to care about women is not sentimental nor out of an inferiority complex but out of economic analysis evidence that emanated from the findings in this study. This study reveals a negative trend between vocational education spending and period poverty. There is a failure in monitoring period poverty to actualisation because there is no congruence between SDGs 1 and 3 due to inadequate women employment because EDUB does not significantly affect WNLFP at a .05 significance level. The long-term success rate of educational funding to improve MMR is doubtful, with the reverse lower limit confidence level of -0.13 because there is no congruence between SDGs 1, 3, 4 and 5, this study concludes that EDUB does not significantly affect WNLFP and MMRIN at a .05 significance level. This study observes serious insufficient information concerning SDGs data in developing economies in many notable search engines. Educational planners and accountants need to rise up to the occasion through further research. The World Bank and academics in developing economies need to partner in this regard. This study has implications on scarce resource allocation for the budget office and legislators to accomplish UN SDGs Vision 2030 sooner than later.

Keywords: Accountability, Educational Funding, Period Poverty, Vocational Education, Women, UN SDGs 2030.

Introduction

In line with the expectation from the United Nations' Sustainable Development Goal (UNSDG)1 expecting zero poverty by 2030, many organisations such as the World Bank and IMF have shown concern with alarming and dangerous statistics on the rising poverty level, especially in Africa. For instance, IMF statistics on the poverty rate show a rising rate for people in extreme poverty and escalating every minute (World Bank, 2025). The connection between the various SDGs and poverty is a concern of this study. For instance, SDG 4 requires education for all by 2030, but education is connected to poverty, yet there is not enough discussion on the links between SDGs 1 and 4. More so, SDG on gender equality interrelates with SDG1 and 4 because 60% of the impoverished people are women. More bothersome is that the poor women are mostly those in menstruation periods who are school-age girls of 14 years or older. Their education has been affected due to menstrual issues resulting in their inability to attend schools during their period due to menstrual pain and inability to procure period materials such as sanitary pads due to poverty, as the segment in focus is usually uneducated and unemployed. Despite increasing educational planning with consistent annual budgetary allocation to education in Nigeria, they lack the required means of livelihood to attend school regularly and get educated. For instance, the Nigerian annual educational budgetary allocation declined from 9.5% in 2015 to 7.3% in 2025 (Ohaegbulem & Chijioke, 2023) (See Appendix 1). The female poverty rate deteriorated from 49.7% in 2015 to 51.77% in 2025 (UNWOMEN, ND) (See Table 2). Jerumeh (2024) explains that women are the hardest hit by the devastating effect of extreme poverty regarding their standard of living. He argues that education is the primary cause of poverty in women because 31.22 % of Nigerian women have no education at all, while only 6% of them have tertiary education. Similarly, Anyanwu (2010) avers that lack of education could affect poverty.

There are different categories of education in Nigeria, particularly based on the 6-3-4-4 education system, suggesting 6 years, 3 years, 4 years, in primary, junior secondary, senior secondary schools and 4 years at the tertiary level respectively. Tertiary education covers vocational and technical schools, polytechnics and universities. It is also noteworthy that while primary and secondary education are mainly free, tertiary education is not free. Also, it is noteworthy that vocational education, among the dimensions of education covered at the tertiary level, is more affordable than university education. This study is an attempt to reveal the danger posed by the wide gap in the gender of tertiary education graduates. Despite that vocational education is more affordable than other tertiary education types, only 2.1%, 30.8%, 2.1% and 27.2% of women are in construction, Information Technology, transportation and storage and professional, scientific and technical activities, respectively in 2023 (Nigeria Bureau of Statistics, 2023). However, the concentration on gender in pursuit of women's empowerment suffers from poor statistics and general data currency in Africa. Anyanwu (2010) avers that Africa has lagged in developing and using gender statistics, with attendant consequences. Hence, there is a need to expose and mainstream gender issues into national statistical systems. Scholars such as Anyebe (2017) argue that female poverty starts at primary school age when they should be in school, but most of them are not. He argued that the educational trend should be addressed for poverty eradication because the girl child's education is critical to achieving SDG 1.

Given the scarcity of data on gender poverty and the consequence of gender poverty, especially on menstrual health, this study further focuses on poverty as a maternal mortality issue concerning the achievement of SDG 3 on good health and wellbeing in Nigeria. Maternal mortality rate trend is of concern to UNICEF (n.d.). Ifeanyi et al. (2019) explain that poverty gives women psychological trauma. Furthermore, due to the popular connection of gender poverty to education, this study covers educational funding accountability. Accounting for educational spending should improve gender psychology in managing their health and wellbeing. Therefore, to bridge the gaps

of data deficit, this study covers education and poverty from the education budgetary allocation as a determinant of menstrual poverty in terms of healthy living and general women poverty trend because budgetary allocations should lead to the actualisation of dreams concerning SDG1 as an accountability measure. In addition, this study covers Nigeria to bridge the local data scarcity gap identified by Anyanwu (2010) because there are still issues needing resolution, notwithstanding that Nigeria is endowed with youthful labour, she is also endowed with natural resources such as bitumen, coal, cocoa, and arable land.

This study exposes education funding accountability as a significant area of concern in SDG 1 accomplishments. It uniquely connects four SDGs, SDGs 1, 3, 4, and 5, on zero poverty, health and wellbeing, quality education, and gender equality to suggest solutions to SDG1 realisation. This study contributes new, unique constructs to earlier studies on poverty, such as Eneji et al. (2025). This study pinpoints the interconnectivity of SDGS towards poverty eradication. This study is an effort to continue the literature on period poverty as it brings currency to the contemporary issue. Therefore, this study covers vocational education funding accountability and period poverty- interconnecting UNSDGS 1, 3, 4 and 5 to achieve zero poverty by 2030

Statement of the Problem

Due to extreme period poverty, the Nigerian woman suffers high levels of health issues surrounding birth, which is contributing 10% of global maternal deaths, which is the 4th highest on earth. Because mothers are not healthy, their babies are undernourished and also recorded a high death rate. However, a government would be willing to invest in pursuit of the highest returns, and all the investments can't give equal returns; priority and resource reallocation would set in. Furthermore, considering the four broad categories of resource scarcity in an economy in terms of a lifetime for labour resources, capital as the scarcity of funds, wealth as the value-adding creation, and nature as endowments of natural resources, appropriate fund planning allocation is required.

Although the budgetary education allocations are steady, they are far below the 26% recommended by UNESCO. It has never passed 10% (UNESCO, 2015a). Moreover, the proportion of those with access to it is also low. Lactating mothers are hungry and they combine laxation with menstruation because they have no employment, are not aware of their condition and cannot give their babies the minimum acceptable feeding. Henceforth, compounding the poverty cycle. For instance, between Q2 and Q3 of 2023, Unemployment rate increased by 1.4%, while the poverty rate fell by 0.4% during the same period. The period poverty affects 37 million women and girls to the extent that they cannot afford menstrual products such as sanitary pads and menstrual pain-relieving medication. This study observes that vocational education is not encouraged in the girl-child to their detriment. Hence, 29.4% of the population were young girls and women in 2017 (United Nations Population Fund, 2023), with menstrual needs poverty. Therefore, the motivation for this study is the need to create awareness through quality education so that the girl-child have equal opportunity to embrace affordable vocational and technical employment and a long-lasting social and economic security. She could understand the implications of her decisions and health conditions, read medication prescriptions and dosages and earn a living towards improving her health standard and zeroizing poverty by 2030.

Aims and Objectives

This study is to aid the improvement of a girl-child education so that she can comprehend the implications of her decisions and escape period poverty. There are two objectives for this study as follows:

- i. Examine the effect of educational fund budgetary allocation on menstrual health rate in Nigeria; and

- ii. Investigate the effect of educational fund budgetary allocation on the maternal mortality rate in Nigeria.

The research question is: How does educational fund budgetary allocation affect menstrual poverty regarding women not in the labour force participation rate (WNLFP) and maternal mortality rate for Nigeria (MMRNI)?

This study covers how women's education affects their financial status regarding their health appreciation, awareness, and comprehension of poverty eradication in Nigeria. The analysis covers related secondary data available in Nigeria for 25 years, from 2000 to 2024. The coverage showcases vocational and technical education as more affordable and desirable for the Nigerian girl child. However, the data available on funding is the general educational budgetary allocation. The students as the educational outputs in vocational, science and technology have not fully embraced any form of entrepreneurship as expected. This multidisciplinary study covering education, accounting, medicine, planning and statistics is helpful to academics and researchers as a reference for further study. World Bank would gain from this study in data provision. Policy-makers would find it helpful for decision-making about gender issues. It buttresses the need for gender budgeting to pinpoint and monitor gender coverage in policy formulation and execution. Donor agencies such as UNICEF would find this study helpful in analysing focus areas. Health-related stakeholders such as medical doctors, educational planners, and accountants will use this study for planning. Accountants and women's organisations such as UNWOMEN could use this study for budgetary performance analysis. Legislators such as house committees on public accounts, women's affairs, and health could use this study to evaluate and monitor Government programmes and agenda status concerning vocational education and women health.

Literature Review

Vocational and Technical Education (TVET)

Different scholars have broadly defined education as an essential tool for self and national socio-economic development (Birley, 2017). Higher education is the education in tertiary institutions, including colleges of education, universities, polytechnics, and technical and vocational colleges (Lawal & Braimoh, 2018). It is the kind of education that gives learners the experience and knowledge that helps them build careers and become employable, thus securing jobs and becoming professionals in their chosen fields. This form of education provides certificates to the learner at the end of the program, which certificate will usually qualify the graduate to secure jobs in their chosen fields of interest. Although there are different qualifications under higher education, academic awards are also issued under this kind of education.

However, the world is changing with women's poverty, food security, land sustainability, environmental protection and multi-economy climate change issues involving petrol and biofuels. Hence, educationists such as Alani (2004) have emphasised the psychomotor learning domain grooming for skill acquisition; they are also concerned about financing vocational and technical education, because if financed, the economic developmental aim of Nigeria would materialise. Such skill acquisition could be through vocational and technical education, which involves acquiring practical, scientific, and applied skills.

TVET allows the Nigerian youth, including the deprived, unemployed youth, to develop and nurture a talent to drive their passion towards wealth creation, to emulate household names in business successes and become renowned names of their own such as Paystack and Interswitch Start-Ups by Nigerian youths. Vocational education produces a well-grounded entrepreneur who would positively impact the business world and society, such as farmers, business managers and hospitality experts, to improve their knowledge and enhance their prospects. TVET philosophy

anchors on the national policy on education (Federal Republic of Nigeria, 2014), is a long-term investment in the nation's future. The policy is to augment human dignity through work and labour by making individuals acquire employable skills, competences, and character, to be self-reliant either as an employee or as an employer of labour for a comfortable living in person and contributing to national economic development in general.

However, TVET is a capital-intensive field based on skills and practicals. Many tools, such as specialised equipment for automotive repair, machinery for carpentry, and buildings for practical training, are usually involved, unlike in liberal education, where a piece of board, marker, or instruction materials would generally suffice. Henceforth, building and equipping laboratories, demonstration farms, keyboarding or fine arts studios, workshops, and human resources management require a lot of money. Nonetheless, in line with the economic theory of scarce resources principle, financial constraints hamper progress in those areas because many programmes compete for limited resources.

Smith (2024) argues that because a government would be willing to invest in pursuit of the highest returns, and all the investments cannot give equal returns, priority and resource reallocation would set in. Furthermore, considering the four broad categories of resource scarcity in an economy in terms of a lifetime for labour resources, capital as the scarcity of funds, wealth as the value-adding creation, and nature as endowments of natural resources, appropriate fund planning allocation is required. However, there are issues because notwithstanding, that Nigeria is endowed with youthful labour at about 75% or about 155 million people of her population (Afolabi, 2021), She is also endowed with natural resources such as bitumen, coal, cocoa and arable land. Nevertheless, there is policy summersault and no common goal congruence on labour and infrastructural planning. Furthermore, poor planning at the rural infrastructure level is driving the youths away from the resources centre to the urban area coupled with the brain-drain syndrome.

Education Financing in Nigeria

Unlike Basic education, Higher education in Nigeria is not free, while the payment made for education under higher education varies. The amount prospective students who secure admission into polytechnics pay is different from the amount paid by those who gain admission into the Universities. The funding model, which sees that higher education is subsidised for Nigerian youth, had brought about an altercation between the Nigeria Government and varsity lecturers, which has resulted in the disruption of the academic calendar through strike action initiated by varsity lecturers to drive home their demand of adequate funding of education. With a growing population and a literacy rate of 62.02%, Nigeria spent 5.14% of its annual total budget on education in 2021, with a decline in funding between 2017 and 2019. It increased by 0.01% in 2021. In 2020 it was 5.13%, a 0.72% decrease when compared with that of 2019 (Macrotrends, 2025). The recommended threshold of 26% whereas Nigeria has never passed 10% (UNESCO, 2015a)

The sources of funding include government allocations of Internally generated revenue (IGR), Research and Grants, and Private partnership initiatives. For example, Ogwo (2024) expresses that the Entrepreneurship and Skills Development Centre (ESDC) is a key area in the University of Lagos's 25-year strategic plan that requires. ESDC leverages international partnerships; in addition to providing vocational knowledge, they aid innovative learners in Start-Ups with seed funds and patenting. The plan is to diversify from the traditional funding to the innovative funding. Over the years, the Government has implemented several initiatives to reform the Nigerian educational System. The Government has systematically increased the funds allocated to tertiary institutions, and the total Government allocation to education has grown yearly. In the 2023

budget, the Government increased the education budget to N75 billion (Budget Office of the Federation, 2022).

Furthermore, Agwulonu and Akanji (2025) explain that Nigeria unveiled an allocation of over ₦3 trillion to education, which is 7.3% of the total national budget which is an improvement over that of 2024. The allocation improves from earlier allocations sourced from the Budget Office of the Federation (2022) (See Appendix I on Government budgetary allocation for 2000 to 2024). The Government explains that the 2025 education provision improvement indicates the priorities set for youth so that computing and information technology careers can be learned at a technical school. Vocational education combines several skills of patience, perseverance, persistence, and keen desire, which are the hands-on skills needed to create a job.

Although, Nigeria has not been meeting the UNESCO standard for education allocations. For instance, the 2030 Education Framework for Action (EFA) advocated benchmarks for education funding at around 6% of GDP OR 20% of public expenditure (UNESCO, 2015a). Scholars such as Oguntoye and Alani (1998) are concerned about funding issues, necessitating more efforts to resolve them.

The challenges of financing vocational and technical education

The notion of sustainability in education funding has become an increasingly important policy objective for the Government at different levels and in the private sector to imbibe (Bello et al., 2025; Eneji et al., 2025). However, there are challenges in financing education due to poor planning and funding (Ogunode, et al., 2021). Furthermore, the poor funding to education sectors necessitated UNESCO to suggest that 26% of the total annual budget should be allocated to the education sector as the minimum benchmark for every developing country. Ohaegbulem and Chijioke (2023) argue that Nigeria could not adhere to any of UNESCO's 26% recommended benchmarks for 1999-2021 due to political instability, corruption and policy summersaults.

Consequences of Educational Funding Challenges on the Girl-child

Poor educational funding challenges have many challenges, including formational issues such as menstrual poverty and maternal mortality rates.

Period poverty

There are many causes of period poverty in Nigeria, such as poor funding and insecurity (Uzoka, 2007; Mamu, 2022). For instance, the insecurity of the girl-child learner got to its peak on April 14 2014, as a result of the kidnap of 276 secondary school girls in Chibock secondary school with loss of lives and property. CNN (2025) explains that 100 of the kidnapped girls are still not found as of April 2024 and that attacks on the girl-learner worsen day by day due to insurgency culminating in poverty. Onwuka et al. (2019) argue that poverty gives women psychological trauma as they are less involved in production, as shown in Appendix II on Nigerian women involved in production. Therefore, because the girl-child is not educated, she cannot embrace meaningful means of livelihood, yet she menstruates from age 12 to 50 around 13 times every year of life. Because she is not educated, she suffers from extreme poverty and cannot buy her health needs, especially sanitary pads. She is thus psychologically withdrawn from schooling and social life; she has no means of livelihood nor adequate care and support while in her periods. Hence, she suffers from period poverty. Girod et al. (2017) argue that menstrual health is a condition of physical, psychological, and social well-being. It is a pressing issue that seriously disturbs women's lives and requires sustainable attention and action, especially from the angle of women not in labour force participation and maternal mortality rates.

Women not in labour force participation rate

The poverty issue is unhealthy, yet many menstruating women are not educated enough to participate in meaningful sustenance jobs in the labour force participation rate, suggesting that they are not working to earn a living and so cannot afford period needs. For example, Appendix 4 shows that about 38% of women have remained unproductive on average over the period 2000 to 2024 in a society whose population is 49.95% of women as of 2020 (Nigeria Bureau of Statistics, 2021). Henceforth, in this study period, poverty connotes women not in the labour force participation rate. Moreover, the suffering from menstrual poverty is massive, with a multiplier effect on the National economic development. Henceforth, the interconnectivity of continuous spending and menstrual poverty requires investigation to improve the status quo. Hence, this study formulates hypothesis 1: H_{01} : There is no significant effect of educational funding budgetary allocation on women not in labour force participation rate.

Maternal mortality rate

Lack of education compounds nutrition and medical problems since there is hunger without antenatal and gynecological care. The trauma of high maternal neglect due to ignorance makes women die from pregnancy complications while pregnant or within 42 days after (Ajegbile, 2023; Dogbanya, 2025; World Bank, 2025a). Anyebe (2017) argues that education has the power to improve earnings distribution across genders and slow down poverty. The need to target a long-lasting solution to the illiteracy rate and its consequences of unemployment, poverty and maternal mortality rate, as aforementioned explains the reason for hypothesis 2, which states that H_{02} : Educational fund budgetary allocation has no significant effect on maternal mortality rate in Nigeria.

Gaps in the Literature

This study is necessary because there are still some unresolved areas in the subject matter concerning, jurisdiction, data coverage, currency and idea. For example, Brinkley and Niebuhr (2023) covers Period poverty as stigma that has to be corrected. Wolff et al. (2024) argue in favour of women protection while in their period through appropriate government aids and policies but their study did not cover Nigeria. Wolff et al. (2024) use Myvoice nationwide texts messages to encourage period discussion to create increasing awareness of prevalence of period poverty in the USA. The study is empirical using descriptive statistics. Crawford and Waldman (2020) explain that menstrual issues are obstacles to poverty eradication. They advocate law to control policies towards alleviating women sufferings due to menstruation. This study covers Nigeria a developing economy.

Carneiro (2021) explains that hygiene products, sanitation, investments in educational research concerning menstrual disorders such as endometriosis is crucial and should be incorporated in funding planning to achieve the SDGs. His work does not cover developing economy like this current study. It is also not as current. Girod et al. (2017) contributions on menstrual poverty centre around information dissemination and national planning but do not cover Nigeria like this current study. Anyanwu (2010), covers household issues in gender poverty. He used secondary data covering 1980 to 1996 to buttress his arguments but not particular about period poverty. The study did not extensively connect poverty with education and health as done in this current study. The data used is not current unlike this study that covers 2000 to 2025. He used general poverty headcount ratio whereas this current study focuses on the severity of female poverty. Though his work has a theoretical foundation of Human Capital Theory but it ignored the criticism of the theory, a gap which this current study bridged.

Ajegbile (2023) is more concerned with maternal health without investigating the root cause and did not dig into how lack of education leads to poverty and maternal health issues as done in this study. The work is not anchored on any theory, whereas this current study offers valuable insights through information on women health. The study is also not data driven like this study but it is based on a personal experience. Bleiweis et al. (2020) covers USA, it emphasises that the medical expenses burden has pushed many families into poverty. They used only year 2019 data. This current study uses an extensive data coverage of 25 years. Just like this study it touches on wages and wealth gaps in American women. Onwuka et.al. (2019) brings to the front burner women's deteriorating poverty rate up to 2019. This current study extends beyond 2019 making it more current. Similar to this current study, he uses an interdisciplinary approach covering gender, finance and psychology. However, this current study is at the boundaries of education, accounting, psychology and medicine. Furthermore, Bleiweis et al. (2020) uses survey research design while this current study employs secondary data to actualise its objectives which is more probing of how far educational spending has been accounted for in the educated women turnout.

Anyebe (2017) argues that poverty is non-respecter of any gender though higher in the female gender covering 2017 but it is not particular about education and educational planning and funding like this study. His work is not empirical and not anchored on any theory as done in this current study. Okunola et al. (2017) do not connect to menstrual poverty though it concerns women inequalities in staff categorization in universities with serious case of some Universities where staff members are not appointed as Deans and 6 out of 77 management staff members are women. It is guided by role congruity theory using survey research design whereas this current study uses 'ex-post facto' research design to add novel constructs to scholarship. Uzoka (2007) concentrates on the reorientation of students towards embracing rural living to minimise urban migration through vocational and technological education despite government's efforts at providing equipment which wastes away due to no electricity. She discovers that a significant relationship exists between adequacy of facilities and learners' interest in vocational subjects. This current study advocates vocational education to improve female skills and earnings to minimise menstrual poverty. The gaps identified require a conceptual analysis based on a strong theoretical foundation concerning human capital analysis.

Theoretical Framework

The human resources outcome of educational funding forms the basis of the theoretical choice in this study. Hence, Human Capital Theory (HCT) ideology anchors this study. Human capital is the educational attainment, skills, and outlook towards life based on personal attributes and experience. HCT recognises that labour is a necessary asset for becoming a worker. Hence, a woman needs to acquire education to be employable and earn a living, which will help her to maintain her subsistence in terms of wealth, health, and wellbeing. Leoni (2025) connects human capital with education. Yakubu (2009) explains that Labour planners used the HCT concept since the 1960s. HCT has a self-efficacy outlook (Anyanwu, 2010). The proponent of the theory was Gary Becker, who in 1962 postulated that women with education are less prone to extreme poverty because education leads to employment with growing income over a lifetime, years of experience, and long-life capacity building, a perspective that fosters optimism and a forward-looking mindset.

According to Yakubu (2009), the first distinctive approach from economics to the analysis of the male-female wage gap is based on HCT. The proponent of the HCT, Becker (1975), argues that over their working life, women are less productive than men because they tend to take an employment break for maternity leave and childcare. Furthermore, women bear the primary responsibility for unrewarded household chores. The HCT focuses on the importance of education in women's health and wellbeing. Scholars such as Choudhury and Choudhury (2022) have

criticised HCT as being too simple. However, this study observes that simplicity is not a problem and that the theory's message is a truism unavoidable in women poverty and education scholarship. As such, the theory is relevant to this current study regarding the message of reward that connects education with poverty and wellbeing.

Conceptual Framework

The conceptual framework for this study is presented in Figure 1 below.

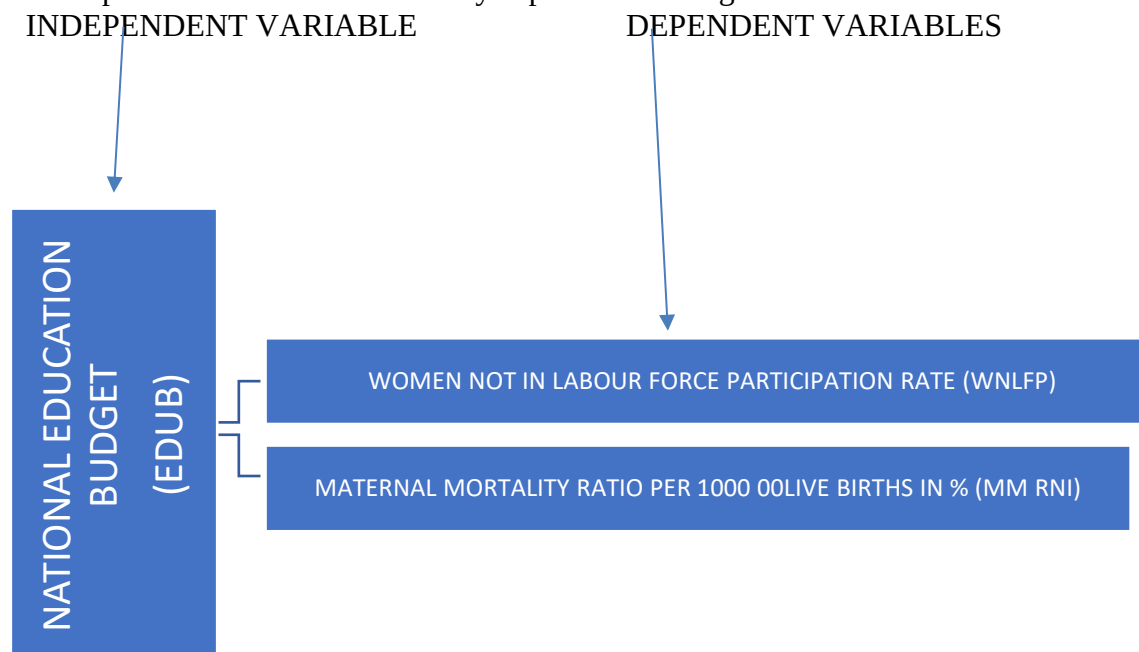


Figure 1: Conceptual framework for studying vocational education funding accountability and period poverty- interconnecting UNSDGs 1, 3, 4 and 5 to achieve zero poverty by 2030

Source: Researcher's design, 2025.

Methodology

This study is a descriptive quantitative ex-post facto work based on secondary data. It covers the 25-year period from 2000 to 2024. The data emanated from the World Bank (2025a) Gender Data Portal, World Bank (2025b) Development Indicators, United Nations Population Fund (2023) Adolescents and Youth Dashboard Nigeria and UNWOMEN (n.d.) SDG Indicator Dashboard—Nigeria. Nigeria Bureau of Statistics (2023) and also from Ohaegbulem and Chijioke (2023). However, meeting the 25-year series required for women's poverty data was difficult. Therefore, this study used the difference between the labour force participation rate (% of population) for women and the entire working-age women population to represent the women in menstrual poverty. This data is innovative compared to what is available in the World Bank (2025b). Because it makes sense rather than to maintain the World Bank's position of insufficient data, World Bank would gain from this study the logic of data availability because if the percentage of those women in employment is known from the total population it implies that the remaining percentage not in labour employment have no earnings and as such fall into menstrual poverty line because most of the time employable women are usually in menstrual age. Furthermore, this study is time series research covering Nigeria. Descriptive statistics and frequencies were combined with inferential statistics that is Pearson correlation and Linear regression r based on multivariate statistical analysis for the data analysis.

Moreover, this study has two variables: dependent and independent. The dependent variable is the Period poverty eradication (MPE) proxy, as women are not in the Labour force participation rate

(WNLFP) and the maternal mortality rate for Nigeria (MMRNI). The independent variable is vocational education funding accountability proxy with the Nigerian annual education budgetary allocation (EDUB). Descriptive statistics, Pearson correlation and Linear regression statistical analysis are used with the aid of SPSS, IBM version 26. Regression analysis addresses the essence of this study. Linear regression is robust and valuable because of its power of prediction and precision (Field, 2020). The decision to use regression analysis for this study is based on the premise that the study meets regression analysis rules in terms of a large sample size. Siamb (2023) used linear regression for education and SDG studies. Siamb (2023) avers that it is necessary to regress the dependent and the determinant variables for assessing their effects. Linear regression statistics are expressed through the equation of a straight line, which in this study of two proxies for the dependent variable stand as:

$$Y_1 = a_1 + bX_1; Y_2 = a_2 + bX_2$$

where X is the independent variable and Y the dependent variable

X_1 is EDUB, a_i is the intercept of model I and b_i is the slope of model I

For Hypotheses 1, the independent variable is EDUB, while the dependent variable WNLFP

The economic model 1 is: $WNLFP = \beta_0 + \beta_1 EDUB + \varepsilon$

$B_1 > 0$.

For Hypotheses 2, the independent variable is EDUB, while the dependent variable is MMRNI

The economic model 2 is Model 2: $MMRNI = \beta_0 + \beta_1 EDUB + \varepsilon$

$B_1 > 0$,

where β_0 = Intercept coefficient and β = Coefficient for the dependent variable and ε is the error term.

Data Analysis and Results

Answer to the research question

Descriptive statistics and Correlation of the dependent and independent variables are used to answer research question and test if the variables relate as shown in Table 1.

Table 1: Shows the result of the descriptive statistics and correlation of the dependent and independent variables test.

Correlations of the dependent and independent variables				
		Mean	Standard deviation	1 2 3
Nigeria % annual budgetary allocation to education (EDUB) (2000-2024)	Pearson Correlation Sig. (2-tailed)	7.48	2.61	
Maternal mortality ratio per 100,000 live births in percentage (MMRNI) (2000 to 2024).	Pearson Correlation Sig. (2-tailed)	1.06	0.12	0.15 0.45
Women Not in Labour force participation rate (% of population) (WNLFP) (2000-2024)	Pearson Correlation Sig. (2-tailed)	37.88	2.72	0.05 - 0.111 0.78 0.598

N=25

Table 1 shows that EDUB does not affect WNLFP and MMRNI to a large extent because the mean score for WNLFP is 37.89%, which is almost static with the situation over the last 25 years. Similarly, for MMRNI with a mean score of 1.065. Because EDUB is not enough to solve

women's menstrual poverty issues, with a mean score of 7% over 25 years, this result indicates that about 37.89% of Nigerian women still suffer period poverty, while the rate of those women who die as a result of pregnancy-related causes has not improved much since 2000 to 2024.

Table 1 shows that the WNLFP and MMRNI constructs correlate with EDUB but not at a significant level because the probability of occurrence is high at .451 for MMNI that is and .780 for WNLFP. When compared with a significance level of .05, two tailed. Hence, this study performs linear regression statistical analysis to test the formulated hypotheses accordingly. See Table 3 for the results.

The null Hypothesis One:

Table 2 shows the results of the test of the null hypothesis one.

Table 2: **Coefficient of EDUB and WNLFP**

Variable	Beta	SE	T	95% CI		B	P	Collinearity Statistics	
				LB	UB			Tolerance	VIF
Constant	37.4	1.71	21.7	33.87	40.9	-	.00	-	-
	31	8	85	6	85		0		
EDUB		.217	.282	-.388	.511	.05	.78	1	1
						9	0		
R	.059								
R ²	.003								
F	.080								
SS residual	178.								
	010								
Df	1								
Durbin	.175								
Watson									

Dependent Variable: WNLFP (2000-2024), b. Predictors: (Constant), EDUB. This study examined the effect of EDUB to predict WNLFP. It entered EDUB as the predictor in the model. $p < .05$.

Table 4 shows an acceptable VIF of below 10, while the Durbin-Watson of .175 is also within an acceptable range of 1.5 and 2.50 (Rosidi, 2021), indicating that the regression result is adequate and reliable. The R² value of .003 indicates that about .3% of WNLFP is predicted by EDUB, which connotes that other factors not covered in this study affect WNLFP. Vocational education proxy of EDUB does not significantly affect menstrual poverty in terms of WNLFP, with a p-value of .451 at the .05 level of significance. In summary, the regression result is ($R^2 = .003$, $F(1, 178.01) = .080$, $p < .05$), ($\beta = .059$, $p < .05$)). This result implies that there is failure in monitoring menstrual poverty to actualization because there is no congruence between SDGs1 and 3 due to inadequate women employment. The results imply that the test of the null hypothesis one posted insignificant outcomes. Hence, the null hypothesis 1 is supported, and this study concludes that EDUB does not significantly affect WNLFP. This result supports the findings in Siambi (2023).

The null hypothesis two

Table 3 shows the result of the test of the null hypothesis two

Table 3
Coefficient of EDUB and MMRIN

Variable	Beta	SE	T	95% CI		B	P	Collinearity Statistics	
				LB	UB			Tolerance	VIF
Constant	1.01	.076	13.22	.852	1.168	-	.000		
EDUB	.007	.010	.766	-.013	.027	.158	.451	1	1
R	.158								
R ²	.025								
F	.587								
SS residual	.352								
Df	1								
Durbin Watson	1.105								

Dependent Variable: MMRIN (2000-2024); b. Predictors: (Constant), EDUB (2000-2024). This study examined the effect of EDUB to predict MMRIN. It entered EDUB as the predictor in the model. $p < .05$.

Table 3 shows an acceptable VIF of below 10, while the Durbin-Watson of 1.105 is also within an acceptable range of 1.5 and 2.50 (Rosidi, 2021), indicating that the regression result is adequate and reliable. The R² value of .025 indicates that about 2% of MMRIN is predicted by EDUB, which connotes that EDUB is too minimal to substantially affect MMRIN, other factors not covered in this study affect MMRIN. Vocational education proxy of EDUB does not significantly affect menstrual poverty in terms of MMRIN, with a p-value of .451 at the .05 level of significance. In summary, the regression result is (R² = .02, F(1, .352) = .587, $p < .05$), ($\beta = .158$, $p < .05$). The longterm success rate of educational funding to improve MMR is doubtful with the reverse lower limit confidence level of -0.13 This result implies that there is failure in monitoring menstrual poverty to actualization because there is no congruence between SDGs1, 4 and 5. The results imply that the null hypotheses of the two tests showed insignificant outcomes. Hence, the null hypothesis two is supported, and this study concludes that EDUB does not significantly affect MMRIN. This result supports the findings in Bello et al. (2025).

Results Discussion

The findings of this study are that there is no goal congruence among Government educational spending accountability and SDGS 1, 3, and 4 concerning women in Nigeria. This result is worrisome because women dominate Nigeria. Their economic status is critical for national development. As such, policy makers need further analysis on how attention should be focused on women so that they have befitting work arrangements to guide against continuous poverty and economic shock. This result clearly shows that without vocational education, women cannot earn a living to take care of their menstrual and pregnancy needs without vocational education. The findings provide valuable insights on why the actualisation of any UN SDGS 1, 3 and 4 is still a dream because women's potentials are untapped. This study shows some of the reasons to account for vocational educational funding through performance appraisal on a gender basis.

Conclusion

The findings imply the need for an appropriate educational funding planning towards vocational education to minimise period poverty by increasing the women employment and productivity rate and reducing maternal mortality rate, so that Nigerians would have a hopeful society saved from the problems of “erroneous education.” Nigeria’s production will rise, and hunger and poverty will be reduced in line with the UNSDGs 2030 expectations.

Recommendations

All three tiers of Government should prioritise vocational education funding in line with the National Blueprint on education (2004) which advocates refocusing on science, technical, and vocational education in the national education system to optimise performance. It is a necessary to pay attention to women’s vocational and technical education because of the crucial roles of women in regenerational process. More resources should be explicitly allocated to education security to minimise insurgence threats to girl-child education as experienced in the 2014 Chibok Girls Saga, where the Boko haram insurgents kidnapped some school girls, resulting in loss of lives and termination of the education potential of some of the girls and reversing their life aspirations. The findings necessitate collaboration between education authority, security agencies and education planners. Using a management information system to carry out educational planning is necessary for data storage and availability. Using technology to plan for education. Through appropriate, business models and investment decision analyses, such as cost-benefit analyses, are necessary for educational fund management. This study covers Nigeria further studies could cover other economies and their comparisons.

Implications for Practice

This study observes serious insufficient information concerning SDGS data in developing economies in many notable search engines. Statisticians, accountants, and educational planners need to rise to the occasion because developing economies' academics need to blow their trumpets. This study has implications for scarce resource allocation for the budget office and legislators if Vision 2030 could be accomplished.

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EXPLORATORY REVIEW OF THE POTENTIALS, IMPACTS, AND ETHICAL DIMENSIONS OF ARTIFICIAL INTELLIGENCE IN HOME ECONOMICS EDUCATION

¹Abigail Olukemi Olugbamigbe & ²Feranmi Boluwatife Oluwagbemileke

¹Department of Home Economics,
Adeyemi Federal University of Education, Ondo City

²Department of Consumer and Home Economics,
Ladoke Akintola University of Technology, Ogbomoshosho
kemiolug@yahoo.com

Abstract

This study critically reviewed the potentials, outcomes, and ethical challenges of Artificial Intelligence (AI) integration in Home Economics education between 2010 and 2025. Drawing on peer-reviewed studies, expert reports, and recent technological updates, the study explores how AI tools are transforming teaching processes and learning outcomes across core Home Economics domains, including personal finance, food and nutrition, housing, fashion, and family development. The findings reveal that AI enhances personalization, engagement, sustainability practices, and inclusivity, thereby aligning with the life-based and holistic orientation of the field. At the same time, significant concerns—including algorithmic bias, data privacy risks, infrastructural inequities, and the erosion of foundational skills—signal the need for cautious, ethical, and equity-focused deployment. The review concludes that while AI holds promise for enriching Home Economics education, its integration must be guided by human-centered values and robust policy frameworks. Recommendations include ethical safeguards, AI literacy development, culturally relevant applications, and targeted teacher capacity-building.

Keywords: Artificial Intelligence (AI); Home Economics Education; Educational Technology; Ethical AI; Sustainability

Introduction

Artificial Intelligence (AI) fundamentally refers to the simulation of human intelligence processes by machines, particularly computer systems. These processes encompass learning, reasoning and self-correction. Learning involves the acquisition of information and rules for its use; reasoning applies these rules to reach approximate or definite conclusions; and self-correction enables systems to refine their performance over time (National Education Association [NEA], 2025). In essence, AI systems are designed with human-defined objectives to perform tasks that traditionally require human or animal intelligence, such as identifying patterns, understanding natural language, producing content, making predictions and decisions, giving recommendations, solving problems, or adapting to new information and circumstances.

The accelerating pace of AI development, with new models and tools introduced frequently, necessitates continuous re-evaluation of its educational implications. It is crucial to distinguish between two broad forms of AI to understand its current capabilities and future potential in education: Narrow AI and General AI. Narrow AI (or weak AI) operates under a limited set of constraints and is designed to perform specific tasks, such as voice recognition (e.g., GBoard, Siri or Alexa) or driving a vehicle. Most AI encountered today fall into this category (Labbe & Wigmore, 2024). Most practical applications discussed in education, such as personalized learning

or automated grading, fall under Narrow AI, meaning they are designed for specific educational tasks.

General AI (or strong AI) remains a theoretical concept, referring to AI capable of performing any intellectual task a human can, with abilities to understand, learn, adapt, and apply knowledge across diverse domains (International Business Machines [IBM], 2023). The concept of General AI replacing human teachers entirely remains largely theoretical, which helps to focus attention on current, tangible impacts. A particularly prominent type of AI that has emerged recently is Generative AI.

Generative AI tools, exemplified by tools like ChatGPT, CoPilot, and Gemini, can produce human-like text, speech, images, or code. They have attracted significant attention in recent years, though reactive and predictive AI tools have been in use for some time (IBM, 2023). Generative AI, with its ability to create content, introduces unique opportunities, such as curriculum generation, but also significant challenges, including academic integrity and misinformation, which require distinct ethical considerations and pedagogical strategies compared to earlier forms of AI (Perkins et al., 2024; Cotton et al., 2023).

In the educational context, AI tools and systems are aimed at supporting various stakeholders – students, teachers and institutions, as identified by World Economic Forum (2025). Student-focused AI tools provide adaptive tutoring systems, automatic writing evaluation, and chatbots; teacher-focused AI tools offer assessment supports, lesson planning tools, and resource curation systems; and institution-focused AI tools assist with school and campus administration and operations, such as scheduling and identifying at-risk students. The application of these tools still need to be reviewed in a life-based field like Home Economics.

Home Economics, often referred to as domestic science or Family and Consumer Sciences (FCS/FACS), is an interdisciplinary field dedicated to human development, personal and family finances, consumer issues, housing and interior design, nutrition and food preparation, as well as textiles and apparel (Oluwagbemileke et al., 2025). This broad scope highlights its focus on practical life skills essential for individual and family well-being. The discipline is recognized as a life-oriented discipline essential for equipping learners with real-world skills.

The interdisciplinary nature of Home Economics makes it a unique and critical lens for evaluating AI's impact on holistic human and family well-being, demanding a comprehensive assessment beyond single-subject academic outcomes. The wide array of practical life skills encompassed by Home Economics, from financial literacy and nutrition to housing and human development, means that AI's influence in this field is not confined to isolated academic subjects. Instead, it has ripple effects across interconnected domains that directly impact daily living and family welfare. For example, an AI tool designed for meal planning in nutrition education might also affect household budgeting in personal finance and time management in resource management. Therefore, evaluating AI's potential from a Home Economist perspective requires a holistic assessment of its impact on overall quality of life, practical decision-making, and family resilience, rather than merely focusing on improvements in a single learning metric.

Objectives of the Study

The objectives of this review are to:

1. categorize specific AI applications across the core domains of Home Economics education;
2. synthesize the reported benefits of AI integration on educational processes in Home Economics;
3. compile the documented benefits of AI on educational outcomes within the domains of Home

Economics; and

4. document the challenges associated with AI integration in Home Economics education.

Research Questions

The reviews answered the following questions:

1. What are the specific AI applications across the core domains of Home Economics education?
2. What are the reported benefits of AI integration on educational processes in Home Economics?
3. What are the documented benefits of AI on educational outcomes within the domains of Home Economics?
4. What are the challenges associated with AI integration in Home Economics education?

Scope of the Study

This systematic review aims to expansively engage the existing literature on Artificial Intelligence's potential for improved educational processes and outcomes within Home Economics, covering the period from 2023 to 2025, reflecting the *latest progress in the field*.

Methodology

This study adopted an integrative literature review approach to explore the potentials of Artificial Intelligence (AI) in enhancing educational processes and outcomes from a Home Economist perspective between 2010 and 2025. Unlike a strict systematic review that restricts inclusion to empirical studies meeting specific methodological criteria, this review embraced a broader evidence-based approach, including peer-reviewed articles, professional reports, institutional publications, and expert insights, to ensure a holistic understanding of current trends and future directions.

Information Sources and Search Strategy

The review drew on a diverse array of reputable sources, including academic databases such as Google Scholar, MDPI, and ResearchGate; institutional repositories from professional and educational technology bodies (e.g., World Economic Forum, CSUN, IBM); and curated expert commentary. Additionally, AI-enabled search tools—particularly the Gemini “Deep Research” engine—were used to enhance the breadth of the literature scan. However, all AI-suggested outputs were subjected to human verification and critical appraisal to ensure contextual accuracy and relevance.

Search terms combined domain-specific and technology-related keywords, such as “Artificial Intelligence in education” OR “AI for learning” OR “intelligent tutoring systems” OR “generative AI”, “Home Economics” OR “Family and Consumer Sciences” OR “nutrition education” OR “personal finance” OR “life skills education”. The time filter was deliberately set to include literature from 2023–2025 to ensure the review captured the latest developments in both AI technologies and their educational applications.

Inclusion Criteria and Selection Process

Materials were included based on the following criteria:

- Direct or inferred relevance to educational applications of AI, especially in life-based disciplines.
- Explicit mention or alignment with Home Economics domains (e.g., financial literacy, food and nutrition, textiles, family well-being).

- Inclusion of practical use cases, theoretical insights, or policy perspectives related to AI integration in education.
- Written in English language.
- Publication between 2010 and 2025.

Data Organization and Thematic Analysis

Selected literature was organized and coded according to core Home Economics domains. The extracted data were grouped under the following thematic categories:

- Types of AI tools and technologies applied (e.g., chatbots, intelligent tutors, generative AI).
- Areas of educational impact (processes such as instruction, assessment, communication; outcomes such as financial literacy, sustainable practices, family wellbeing).
- Documented or theorized benefits.
- Ethical, operational, and equity-related concerns.

The synthesis followed an interpretative-descriptive approach, drawing connections across diverse sources to identify patterns and articulate implications for both theory and practice in Home Economics education.

Review Limitations

Efforts were made to ensure comprehensiveness, but certain limitations persist. First, non-English sources were excluded, potentially omitting relevant perspectives from non-Anglophone regions. Second, due to the evolving nature of AI and the scarcity of domain-specific research on Home Economics, some findings were extrapolated from adjacent fields or expert perspectives. Lastly, while AI tools supported the data search, all interpretations and conclusions were finalized by human reviewers to ensure scholarly integrity.

Results

Research Question 1: What are the specific AI applications across the core domains of Home Economics education?

AI applications span all core domains of Home Economics, demonstrating integrative potential for transforming practice and pedagogy. The table below summarizes domain-specific AI innovations.

Table 1: Specific AI Applications Across Home Economics Domains

AI Application Sub-Point	Citations	Areas of Application
Personal Finance		
• AI chatbots like Cleo automate saving suggestions and track expenses.	Bergman (2025); Garnett (2025)	Budgeting & Savings
• Tools such as Tally provide repayment automation and AI-powered recommendations.	SoFi (2025)	Debt Management
• Robo-advisors simulate investment outcomes based on individual financial profiles.	Bergman (2025)	Financial Planning
Nutrition & Food		
• AI platforms (e.g., Ollie) generate meal plans matching dietary needs.	Sharma (2025)	Meal Planning

• Tools use image recognition to estimate nutritional content in real-time.	Kassem et al. (2025)	Dietary Assessment
• Household AI systems track expiration dates and suggest recipes from leftovers.	Clark et al. (2025)	Food Waste Reduction
Housing/Resource Management		
• AI optimizes heating and power use based on occupancy and climate.	McKenna (2025)	Smart Energy Systems
• Design simulations predict energy savings in building plans.	McKenna (2025)	Sustainable Design
• AI categorizes and manages household waste more efficiently.	California State University (CSUN, 2025)	Recycling Management
Textiles & Apparel/Fashion		
• AI-assisted patternmaking minimizes fabric waste.	Premiere (2024)	Vision Sustainable Design
• Algorithms calculate precise fabric use.	Premiere (2024)	Vision Fabric Optimization
• AI identifies recyclable textiles and eco-conscious alternatives.	Premiere (2024)	Vision Circular Fashion
Family & Human Development		
• AI apps offer personalized parenting advice.	Ayomi (2025)	Conflict Resolution
• Smart assistants generate messages between teachers and families.	DeFlitch Szondy & Magyary (2025)	(2025), Communication Support
• AI platforms schedule and document care routines for children with special needs.	Szondy & Magyary (2025)	Special Needs Support

This table shows that AI applications span all core Home Economics domains. In Personal Finance, AI chatbots and robo-advisors automate budgeting, savings, and debt management, offering personalized financial guidance. For Nutrition, generative and analytic AI produce individualized meal plans and nutrient tracking, while smart sensor systems (modeled on hospitality waste-reduction AI) help households manage food spoilage. In Housing/Resource Management, AI-driven home energy systems (e.g. AI-based HVAC control) optimize resource use and sustainable design. Textiles/Fashion benefits from AI in design, where 3D simulation and predictive patternmaking reduce waste and improve efficiency. Lastly, in Family and Human Development, emerging AI tools support conflict resolution (AI parenting coaches) and improve communication and special-needs care by automating scheduling and documentation. These findings suggest AI is being explored in pedagogical contexts to enhance traditional Home Economics topics, though many examples come from industry or pilot projects rather than formal curricula (Sharma, 2024). Notably, several domains emphasize sustainability (food waste, eco-friendly fashion), reflecting current priorities in Home Economics education.

Research Question 2: What are the reported benefits of AI integration on educational processes in Home Economics?

Information in literature indicates how AI is improving educational processes like lesson delivery, administrative efficiency, and learner support, as presented in Table 2.

Table 2: Reported Benefits of AI Integration on Educational Processes

Reported Benefit	Citations	Area of Application
AI-powered simulations improve student engagement with budgeting concepts.	Oluwagbemileke et al. (2025)	Engagement & Gamification
Intelligent tutoring systems adjust difficulty based on learner performance.	God of Prompt (2025)	Adaptive Practice
AI chatbots deliver individualized dietary coaching.	Sharma (2025)	Personalized Instruction
Automated nutrition analyzers (e.g. photo logs) give immediate feedback on food choices to reinforce learning.	Sharma (2025); Kassem et al. (2025)	Real-Time Feedback
AI software helps students model energy-efficient homes.	McKenna (2025)	Design Simulations
Tools automate calculations, supporting creative thinking.	CSUN (2025)	Project-Based Learning
Generative AI accelerates brainstorming and design.	Lee & Suh (2024)	Creative Ideation
Pattern-making software enhances hands-on learning.	Refabric (2025)	Skill Development
AI aids special needs instruction with adaptive content.	God of Prompt (2025); Kelly (2025)	Inclusive Learning
Platforms automate clear reporting to parents.	DeFlicht (2025)	Improved Communication

The table highlights how AI integration can transform teaching and learning methods in Home Economics. Across domains, *personalization and engagement* recur as key gains. AI-driven gamification and adaptive tutors make personal finance lessons more interactive, tailoring practice problems to student needs. Nutrition education witnesses data-rich feedback loops: AI apps personalize meal planning and instantly analyze students' dietary choices, reinforcing lessons outside the classroom. In the Housing domain, advanced simulations let students experiment with energy-system design virtually. A JHU course on Machine Learning for HVAC systems exemplifies this (McKenna, 2025). Generative design tools in fashion/textiles accelerate ideation and free students to focus on creativity. For family studies, AI bolsters inclusion as adaptive learning platforms and communication assistants support special needs education and strengthen school–family links. Importantly, the literature suggests educators themselves could leverage AI to automate planning and outreach, though explicit studies in Home Economics contexts are scarce. Overall, these sources indicate that AI can enrich pedagogy by automating routine tasks and enabling differentiated, student-centered instruction, consistent with recent reviews of AI.

Research Question 3: What are the documented benefits of AI on educational outcomes within the domains of Home Economics?

AI's educational impact transcends process efficiency and produces measurable outcomes in life skills, financial behavior, sustainability habits, and family well-being, as presented in Table 3.

Table 3: Documented Benefits of AI on Educational Outcomes

AI-Enhanced Educational Outcome	Citations	Area of Application
Personal Finance		
• AI tools support saving habits and financial goal setting.	Bergman (2025); SoFi (2025)	Improved Financial Behaviors
• Simulations train students in budget-based choices.	Garnett (2025)	Decision-Making Skills
Nutrition & Food		
• AI tracking reduces spoilage, saving money.	Clark et al. (2025)	Reduced Food Waste
• Personalized meal plans improve diet quality.	Wang et al. (2025)	Better Health Outcomes
Housing/Resource Management		
• AI-controlled systems reduce household energy usage.	McKenna (2025)	Energy Efficiency
• Realistic AI-driven models of resource use help students visualize impact, potentially boosting retention of concepts.	McKenna (2025)	Better Engagement
Textiles & Apparel/Fashion		
• AI tools optimize cutting to minimize fabric scrap.	Premiere Vision (2024)	Less Textiles Waste
• Students report faster, more creative outputs.	Lee & Suh (2024)	Better Design Quality
Family & Human Development		
• AI supports language acquisition for non-verbal learners.	God of Prompt (2025)	Improved Communication
• Automation reduces caregiver stress, enhancing learning support.	Kelly (2025).	Family Well-being

Table 3 underscores that AI can translate into measurable learning gains and real-world improvements. For example, in Personal Finance, research indicates AI tutors help students develop better money management skills and meet financial goals. In Nutrition, households using AI-enabled waste monitoring saw dramatic reductions in discarded food (an outcome that directly ties to environmental education goals). AI-driven meal recommendations have also improved health markers in some studies, reinforcing classroom nutrition lessons. In Housing/Resource Management, AI-controlled systems demonstrably enhance energy efficiency, a tangible outcome that students can appreciate in project-based learning. In Fashion/Textiles, empirical work shows fewer prototypes and scraps are needed when AI-assisted 3D modeling is used, delivering cost and sustainability benefits. For Family & Human Development, clinical reports highlight that AI augmentative communication greatly improved language skills in children with autism, and AI scheduling tools have eased caregiver burden. Collectively, these data-driven outcomes suggest AI tools not only enrich classroom instruction but also advance practical skills and wellbeing—aligning with the Home Economics mission of promoting efficient, healthy, and sustainable living.

Research Question 4: What are the challenges associated with AI integration in Home Economics education?

Despite the advantages, several ethical and operational issues are documented to limit AI's full utility in Home Economics. These challenges are synthesized in Table 4.

Table 4: Challenges of AI Integration in Home Economics Education

AI Integration Challenge Sub-Point	Citations	Area of Application
• Biases in credit scoring and recommendations persist.	Boateng and Boateng (2024)	Algorithmic Bias
• Financial data collection risks trust and compliance.	Anjum (2025)	Privacy/Security
• Tech access gaps hinder participation and equity.	Vesna et al. (2025)	Digital Divide
• Health data must meet regulatory compliance standards.	Graf (2025)	Data Privacy
• Smart tools need costly resources and teacher training.	CSUN (2025)	Infrastructure Barriers
• Teachers face steep AI learning curves.	WEF (2025)	Technical Complexity
• AI may limit development of manual design skills.	Lee & Suh (2024)	Over-Reliance
• AI material suggestions may conflict with sustainability.	Refabric (2024)	Ethical Concerns
• AI parenting tools may violate consent norms.	Szondy & Magyary (2025)	Ethics and Privacy
• Low-income households face greater barriers to AI benefits.	Vesna et al. (2025)	Equity

Despite its promise, AI integration faces significant challenges. A major concern is equity of access – many schools and households lack the infrastructure or funding for advanced AI tools. This digital divide means disadvantaged learners could be left behind. In domains like Personal Finance, algorithmic bias is a risk: AI models trained on historical data may perpetuate unfair lending or investment outcomes. Privacy is another ubiquitous issue; collecting students' health, financial or family data requires strict safeguards (Kelly, 2025). In the Textiles domain, educators note that over-reliance on generative design might undercut skill acquisition. Similar caution arises in the Family domain: although AI could improve family communication, it also intrudes on family privacy (Szondy & Magyary, 2025). Teachers must also navigate a steep learning curve; many lack training in AI literacy (World Economic Forum, 2025), complicating implementation. In summary, while AI tools are powerful, their adoption in Home Economics education must address biases, ensure data privacy, and bridge access gaps through inclusive policies

Discussion of Findings

The findings show that AI is being deployed across all core domains of Home Economics, with a wide variety of applications tailored to practical life tasks and pedagogical objectives. In personal finance, AI-powered platforms such as Cleo and Tally provide budget tracking, saving advice, and debt management simulations (Bergman, 2025; SoFi, 2025). Robo-advisors also facilitate investment planning by simulating financial outcomes based on user profiles (Garnett, 2025). In nutrition education, platforms like Ollie and AI-based analyzers apply image recognition to

estimate nutritional content and tailor personalized meal plans (Sharma, 2025; Kassem et al., 2025). These tools bridge classroom learning and real-life dietary choices, enhancing the functional literacy of students. For housing and resource management, AI enables smart energy systems and sustainable architectural simulations, as seen in AI-enhanced HVAC course modules and predictive design tools (McKenna, 2025; CSUN, 2025). In fashion and textiles, AI facilitates sustainable design through pattern-making software that reduces fabric waste and enables circular fashion initiatives (Première Vision, 2024; Refabric, 2025). Finally, in family and human development, AI systems support parenting, caregiving for special needs, and school-family communication via smart assistants and scheduling apps (Ayomi, 2025; DeFlitch, 2025; Szondy & Magyary, 2025). These applications, although often sourced from industry settings, are increasingly being piloted in educational environments, reflecting a growing recognition of AI's role in enhancing the life-preparation goals of Home Economics (Oluwagbemileke et al., 2025).

AI integration enhances educational processes in Home Economics through personalization, real-time feedback, and greater learner engagement. For instance, intelligent tutoring systems dynamically adjust learning materials based on a student's pace and understanding, enabling adaptive and inclusive instruction (God of Prompt, 2025; Kelly, 2025). AI chatbots offer tailored nutrition coaching, while photo-based food log analyzers provide immediate feedback on students' dietary choices, reinforcing classroom concepts beyond school hours (Sharma, 2025; Kassem et al., 2025). In housing and resource management education, AI-powered simulations allow learners to visualize energy efficiency strategies and model smart home systems (McKenna, 2025). Similarly, project-based learning is enhanced by automation tools that support calculations and design iterations (CSUN, 2025). Generative AI has been shown to accelerate creative ideation in fashion design, allowing learners to experiment with more iterations and explore sustainable options (Lee & Suh, 2024). Importantly, AI-driven platforms also streamline administrative processes like report generation and parental communication (DeFlitch, 2025). These process-level benefits affirm AI's role in reducing instructional workload while enriching the quality of learning experiences. Yet, Home Economics educators must ensure that such tools are deployed not merely for technological novelty but to reinforce the field's mission of promoting life skills, well-being, and reflective decision-making (Oluwagbemileke et al., 2025; World Economic Forum, 2025).

The literature demonstrates that AI tools contribute to tangible improvements in educational outcomes, particularly in the development of life skills, sustainable habits, and family wellness. In personal finance, students using AI budgeting apps have shown improved saving behaviors, goal orientation, and decision-making competencies (Bergman, 2025; Garnett, 2025; SoFi, 2025). AI-enhanced simulations in classroom contexts also enable learners to apply financial theories to realistic scenarios. In nutrition, AI-driven dietary tracking reduces household food waste and improves nutritional quality, linking classroom learning to healthier lifestyle outcomes (Clark et al., 2025; Sharma, 2025; Wang et al., 2025). Housing-related courses benefit from AI-enabled energy modeling tools that foster deeper understanding of environmental efficiency, while also enhancing student engagement through interactive content (McKenna, 2025). In fashion and textile education, studies report improved design quality and sustainability outcomes as students leverage AI to optimize fabric use and minimize waste (Première Vision, 2024; Lee & Suh, 2024). Family and human development outcomes are also positively affected; for instance, AI platforms supporting non-verbal learners and caregivers have enhanced communication skills and reduced emotional strain in caregiving contexts (God of Prompt, 2025; Kelly, 2025). These outcomes support the broader view that AI, when applied purposefully, reinforces Home Economics' integrative focus on physical, cognitive, emotional, and social development.

Despite these benefits, integrating AI into Home Economics education presents a complex set of challenges. Algorithmic bias remains a significant concern, especially in financial and employment recommendation systems, where historically marginalized groups may receive inequitable treatment (Boateng & Boateng, 2025; Marian University, 2025). Data privacy and security issues also arise in contexts involving sensitive health, dietary, or family data—raising ethical concerns about consent, surveillance, and the misuse of personal information (Anjum, 2025; GRAF, 2025). Infrastructure barriers, including lack of internet access and insufficient teacher training, disproportionately affect schools in low-resource settings, deepening the digital divide (Vesna et al., 2025; World Economic Forum, 2025). Pedagogically, concerns persist around over-reliance on AI tools in design domains, where students may bypass foundational manual skills and critical thinking (Lee & Suh, 2024; Refabric, 2024). In family life education, the use of AI for parenting advice or emotional support introduces potential risks of manipulation, detachment, and reduced parental agency (Szondy & Magyary, 2025; Public Square Magazine, 2025). These challenges underscore the necessity of embedding AI within robust ethical frameworks that prioritize human agency, equity, and contextual appropriateness. For Home Economics educators, the imperative is clear: AI must not only be functional but value-aligned—enhancing rather than compromising the holistic well-being of learners and families.

Conclusion

This literature review demonstrates that Artificial Intelligence (AI) holds immense promise for transforming Home Economics education by enhancing both educational processes and learner outcomes across its diverse domains. From personal finance and nutrition to housing, fashion, and family well-being, AI applications have shown the capacity to personalize learning, promote sustainability, improve life management skills, and support inclusive practices. These benefits are not merely theoretical but are increasingly evidenced by recent studies and real-world implementations, particularly between 2023 and 2025. However, these potentials are counterbalanced by significant ethical, infrastructural, and pedagogical challenges—ranging from algorithmic bias and privacy concerns to over-reliance and unequal access. As such, the integration of AI in Home Economics must be approached with caution, intentionality, and a strong ethical foundation. The future of Home Economics education lies in how well it leverages AI to amplify its life-centered mission without undermining the values of equity, agency, sustainability, and human dignity that lie at its core.

Recommendations

Based on the findings, the following are recommended:

1. Home Economics educators and curriculum developers must prioritize human dignity, well-being, and contextual relevance in all AI integrations.
2. AI applications should be localized to reflect cultural, socioeconomic, and ecological realities. For instance, budgeting apps should address currency and economic conditions relevant to learners, and nutrition platforms should incorporate indigenous dietary patterns.

There is a need for domain-specific studies and classroom-based evaluations to move beyond hypothetical potentials. Future research should focus on longitudinal impacts of AI use on students' holistic well-being, decision-making, and real-world adaptability. Stakeholders must demand AI systems that are transparent, unbiased, and inclusive. Tools should undergo routine evaluation for algorithmic fairness, data privacy compliance, and alignment with sustainability and equity goals.

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DEVELOPMENT OF BUSINESS EDUCATION IN NIGERIA: TRENDS, CHALLENGES AND PROSPECTS

Aminu Ahmed Chiroma

Department of Educational Foundations,
Modibbo Adama University, Yola Nigeria,
Faculty of Education,
ngarindeka@yahoo.com

Abstract

Business Education, a vocational field that equips people with the fundamental knowledge and real-world skills needed for self-employment, entrepreneurship, and successful economic involvement is a key component of national development. Due to historical, political, and economic changes as well as growing globalization, business education in Nigeria has seen significant change. The historical evolution, institutional expansion, and changing curriculum of business education in Nigeria are examined in this essay, with an emphasis on the program's contributions to financial literacy, innovation, and unemployment reduction. The main issues affecting the industry are also critically examined, such as a lack of funding, out-of-date curricula, a lack of technological integration, and a teacher shortage. In order to revitalize business education, the study also highlights the significance of public-private partnerships, policy support, and the implementation of contemporary educational methodologies. This study offers evidence-based suggestions for improving the applicability and efficacy of business education in Nigeria by thoroughly reviewing the body of existing literature and policy documents. In order to position business education as a driver for equitable and sustainable national progress, the findings highlight the necessity of consistent investment, strategic reforms, and stakeholder participation.

Introduction

Business Education, a vibrant and essential component of Nigeria's educational system, aims to give students the academic understanding and real-world skills they need for career advancement, personal growth, and the advancement of the country's economy. It emphasizes developing the skills necessary to navigate the complicated, cutthroat, and international business world of today in domains like accounting, marketing, entrepreneurship, management, and information technology. Business education is a heterogeneous field that is essential to technical and vocational training as well as a basis for encouraging creativity and entrepreneurial thinking in young Nigerians (Edomwonyi & Osarumwense, 2017). Business education has the potential to be a game-changer in a developing nation like Nigeria, where youth unemployment and underemployment are still major issues. It can educate learners for multiple professional choices, including self-employment, while helping to the greater aims of poverty reduction and economic diversification (Akpan et al., 2014). Over the years, the growth of business education in Nigeria has been impacted by several variables, including national education policies, global economic trends, industrial demands, and the extension of postsecondary education (Oyewole & Ihionkhan, 2020). This article discusses the evolution of business education in Nigeria, assesses contemporary obstacles facing its implementation, and considers potential for reform. In order to present business education as a catalyst for sustainable development, it also highlights the vital roles that curriculum innovation, teacher preparation, and institutional support play (Sofoluwe et al., 2013).

Nigerian business education's conceptual framework has been growing steadily in response to the country's socioeconomic demands. Business education has expanded to include a wider range of

commercial and management disciplines that are in line with both local and global business contexts, after initially concentrating on clerical training and bookkeeping (Umar, 2024). This change reflects the nation's evolving interests, which have shifted from administrative assistance during the colonial era to contemporary economic independence and competitiveness. Therefore, in addition to preparing students for the workforce, business education now aims to promote a culture of creativity, productivity, and lifelong learning (Ekpenyong & Nwabuisi, 2003). The organization and delivery of business education in Nigeria have been significantly shaped by successive education policies. The National Policy on Education (NPE), which legally acknowledged business education as an essential component of the vocational and technical education stream, is noteworthy among these (Akpan et al., 2014). The policy framework has established the groundwork for curriculum creation, teacher certification, and institutional accreditation, and it has been reinforced by initiatives from the National Commission for Colleges of Education (NCCE) and the National Board for Technical Education (NBTE) (Gabadeen & Raimi, 2012). However, insufficient finance and implementation gaps still hinder the successful achievement of policy goals in spite of these advancements (Okeke & Edikpa, 2014).

Rapid technology breakthroughs and changes in the job market have raised questions about the quality and applicability of business education programs. Graduates with practical skills, digital literacy, and problem-solving ability in addition to theoretical knowledge are in high demand by employers (Ubogu, 2020). Regretfully, a large number of Nigerian business education programs are still out of date and unrelated to actual business operations (Okoro, 2021). To guarantee that graduates can succeed in fast-paced work situations, there is a growing demand for a competency-based curriculum that integrates digital resources, industry collaborations, and experiential learning (Ihugba, Odii & Njoku, 2013). Strategic investments in innovation, human resources, and infrastructure are critical to the future of business education in Nigeria. Sustaining development requires bolstering teacher training institutions, incorporating ICT into instruction, and encouraging cooperation between industry and academics (Rauf, Wijaya & Tari, 2021). Furthermore, in order to contextualize business education to local requirements and match it with global norms, community and stakeholder engagement is essential (Igwe, Okolie & Nwokoro, 2021). Business education needs to be repositioned as a crucial tool of national development as Nigeria seeks to diversify its economy and create a knowledge-driven society (Rashid, 2019).

Historical Evolution of Business Education in Nigeria

In order to support administrative and commercial operations, the British colonial government and missionary organizations founded schools largely to train clerks, typists, and bookkeepers. This is when business education in Nigeria first began. The economic and administrative demands of the era were reflected in these schools' emphasis on basic business skills including typing, shorthand, bookkeeping, and commerce (Edomwonyi & Osarumwense, 2017). The foundation for the formalization and institutionalization of commercial studies in Nigeria's educational system was established by these early business education models, notwithstanding their restricted reach and breadth. Nigerians became more aware of the importance of education in promoting socioeconomic development after gaining independence in 1960. With the creation of the National Policy on Education (NPE) in 1977, the post-independence era saw a move toward organized educational planning. Business education was explicitly recognized as an essential component of vocational and technical education by the policy, which has subsequently undergone multiple amendments (Akpan et al., 2014). It sought to encourage self-employment and lessen dependency on white-collar occupations by giving students entrepreneurial skills and practical knowledge. A more organized approach to incorporating business-related disciplines into secondary and postsecondary education curricula began during this time.

The growth of technical colleges, polytechnics, and colleges of education in the 1980s opened up new avenues for the provision of business education throughout Nigeria. Specialized programs like the National Diploma (ND) and Higher National Diploma (HND) in business-related subjects were offered by these universities. Business education was elevated to a full-fledged academic field when institutions started giving bachelor's and postgraduate degrees in the sector at the same time (Oyewole & Ihionkhan, 2020). This expansion broadened the range of specializations accessible, from office technology and management to business administration and accounting, in addition to expanding access to business education.

Regulatory organizations like the National Board for Technical Education (NBTE) and the National Commission for Colleges of Education (NCCE) were created to guarantee quality and uniformity. These organizations played a significant role in the creation of curricula, accreditation, and quality control in business education programs all around the nation. They set guidelines for course content, teacher qualifications, and learning outcomes, encouraging a more uniform and cohesive business education framework (Ekpenyong & Nwabuisi, 2003). Disparities in institutional ability and execution have remained despite their efforts, especially between public and private providers and between institutions in urban and rural areas (Sofoluwe et al., 2013).

Global economic changes, technology advancements, and the increased focus on entrepreneurship have all had an impact on the development of business education in Nigeria in more recent times. A more modern approach to business education is indicated by national initiatives such as the use of ICT tools in teaching and learning and the introduction of entrepreneurship studies as a required subject at postsecondary institutions (Gabadeen & Raimi, 2012). However, the system is still beset by the legacy of unequal development, inadequate finance, and antiquated teaching methods. In order to address these problems and guarantee that business education stays relevant to modern economic realities, the government, academic institutions, and the private sector must recommit (Rashid, 2019).

Current Landscape of Business Education in Nigeria

Currently, Business Education is being offered at several different educational levels in Nigerian educational system, giving students at different phases of their academic and professional careers a wide range of options. The fundamentals of business are taught to secondary school pupils in courses including bookkeeping, commerce, and financial accounting. These courses are designed to give students a foundational understanding that can act as a springboard for more specialized study. Secondary school is essential for developing an entrepreneurial mindset and equipping pupils for the demands of contemporary economies since it exposes them to business concepts at a young age (Edomwonyi & Osarumwense, 2017).

A variety of credentials are available at the tertiary level for business education, such as the National Certificate in Education (NCE), the National Diploma (OND), the Higher National Diploma (HND), and bachelor's degrees (B.Sc. or B.Ed.) in subjects like management, accounting, entrepreneurship, and business education. These courses, which are provided by universities, colleges of education, and polytechnics, are intended to foster the development of both theoretical understanding and practical abilities. Core business subjects including finance, marketing, management, and information systems are emphasized in the curriculum, with entrepreneurship and digital literacy receiving more attention. Business education has been matched with the objectives of Nigeria's National Economic Empowerment and Development Strategy (NEEDS), which prioritizes youth empowerment through education, poverty alleviation, and skill development, as part of national development programs (Akpan et al., 2014).

The advancement of business education in Nigeria is greatly aided by professional certifications in addition to conventional academic degrees. Well-known associations like the Chartered Institute of Secretaries (CIS), the Association of Chartered Certified Accountants (ACCA), and the Institute of Chartered Accountants of Nigeria (ICAN) provide specialized training programs that enable people to obtain respected credentials in areas like management, accounting, and finance. By offering specific knowledge and expertise that are highly appreciated in the job market, these professional bodies aid in the growth of the workforce. In order to keep people competitive in a business environment that is always evolving, they also provide a platform for ongoing professional development (Sofoluwe et al., 2013).

In Nigeria, the private sector has become more and more influential in determining the direction of business education. Students looking for specialized or globally recognized credentials now have more options thanks to the expansion of business education programs offered by private universities and specialized institutes. In order to better educate students for the job, these schools can adopt cutting-edge courses, integrate new technologies, and form industrial alliances because they frequently have greater flexibility in responding to global trends. A larger portion of the population now has greater access to business education thanks to the growing private sector's involvement, which has also helped diversify the educational system (Oyewole & Ihionkhan, 2020).

Nigerian business education has seen significant change as a result of the recent explosion in online and distance learning, especially in the wake of the COVID-19 pandemic. Institutions can now provide flexible learning possibilities to students who live far away or are unable to attend traditional classroom settings thanks to digital platforms. This change has been especially helpful in increasing access to educational resources and guaranteeing the continuation of instruction during times of disruption. Additionally, the increased focus on online education has resulted in a spike in the usage of digital tools and technologies in the classroom, improving students' digital literacy and equipping them to meet the needs of a global economy driven by technology (Okoro, 2021).

Challenges Facing Business Education in Nigeria

Despite progress, several challenges hinder the optimal development of business education:

Insufficient finance: One of the biggest obstacles to the successful advancement of business education in Nigeria is still a lack of suitable finance. Budgetary allotments for business education are sometimes insufficient to fulfill the rising demands of both educational institutions and students, despite the fact that it is acknowledged as a crucial element of national development (Edomwonyi & Osarumwense, 2017). Because of this, maintaining and enhancing infrastructure, which is essential for creating a favorable learning environment, becomes difficult for colleges and universities (Akpan et al., 2014). Students frequently lack access to basic teaching resources including textbooks, software, and equipment needed for hands-on learning, which prevents them from properly understanding the concepts being taught (Oyewole & Ihionkhan, 2020). Furthermore, the lack of finance has prevented the integration of contemporary technology tools and resources, including as computers, digital learning platforms, and software, which are crucial for educating students to compete in a globalized market (Umar, 2024). Chronic underfunding not only lowers educational quality but also makes it harder for people in diverse parts of Nigeria to get high-quality business education (Sofoluwe et al., 2013).

Curriculum Irrelevance: Nigeria's business education curriculum has fallen behind in meeting the ever-evolving demands of the international business world. One of the most enduring problems is the disconnect between the theoretical knowledge that is taught in classrooms and the real-world

skills that employers in the industry demand. Academic theories and concepts are emphasized in many programs, but they frequently don't translate into practical applications. Since employers are looking for workers with practical experience, problem-solving skills, and current industry knowledge, graduates often find themselves unprepared for the workforce (Edomwonyi & Osarumwense, 2017). This problem is made worse by the absence of corporate participation in the curriculum creation process. Many schools' curricula are still out of date, despite sporadic attempts to include modern subjects like e-commerce, digital marketing, and entrepreneurship (Akpan et al., 2014). In order to ensure that business education is in line with the labor market, promote employability, and support economic growth, it is imperative that this gap between academic content and industry needs be closed.

Teacher Quality: One of the biggest issues facing Nigerian business education is the quality of the teachers. Even while the number of business education programs is increasing, there is still a significant lack of skilled and knowledgeable instructors in the industry. The ability of many business school instructors to provide high-quality instruction is compromised by their lack of professional credentials or postgraduate degrees (Oyewole & Ihionkhan, 2020). Furthermore, many educators are not exposed to the newest teaching techniques, technological developments, or industry trends due to the lack of ongoing professional development for educators. Their capacity to fulfill the various requirements of pupils and adjust to changing teaching methods is hampered by this standstill in their professional development. Lack of resources and support for teacher development programs further affects the quality of instruction (Sofoluwe et al., 2013). It is crucial to make investments in thorough teacher training, offer chances for continuous professional development, and guarantee that educators have access to the tools they need to improve student results and their own effectiveness as teachers in order to improve business education outcomes.

Technological Restrictions: One major barrier to Nigeria's business education modernization is technological restriction. Many Nigerian institutions continue to struggle with inadequate access to contemporary ICT tools and resources, despite the fact that the integration of ICT in teaching and learning has become a global trend. Adequate computer labs, dependable internet connection, and the software needed to properly teach business education subjects are lacking in many schools (Umar, 2024). Furthermore, it's common for both educators and learners to be underprepared to utilize the latest technological advancements. In addition to impeding efforts to modernize business education, the lack of digital resources, interactive tools, and online learning platforms limits students' exposure to international best practices and hinders their development of critical digital skills (Gabadeen & Raimi, 2012). Failure to address these technological limitations puts Nigerian business education at a disadvantage in a world that is rapidly digitizing, limiting students' opportunities to gain the skills necessary to prosper in a global economy that is becoming more and more reliant on technology.

Problems with Perception: In Nigeria, business education is frequently seen negatively, especially when contrasted with more conventional academic fields like engineering, law, or medicine. Many people, including parents and students, think that business education is less important or prestigious than other areas since it does not provide as many professional opportunities or intellectual rigor. Particularly in secondary schools and higher education institutions, this image may lead to a lack of interest in and enrollment in business education programs (Ekpenyong & Nwabuisi, 2003). Furthermore, business education has been marginalized in the larger educational landscape due to its emphasis on largely practical or technical training rather than as an academic discipline. This undervaluation has made it more difficult to recruit skilled workers to the field and obtain the capital and resources required for its

advancement. The significance of business education in fostering entrepreneurship, boosting national economic growth, and tackling pressing employment issues must be emphasized in order to dispel this misconception. Changing public perceptions requires increasing knowledge of how business education may lead to a variety of job options and support national development (Okeke & Edikpa, 2014).

Technological Innovation and Integration: In order to bring Nigeria's educational system into line with international trends and the needs of a technology-driven economy, it is now crucial to include information and communication technology (ICT) into business education. Traditional pedagogical approaches are being transformed by digital tools and platforms including accounting software, virtual simulations, and learning management systems (LMS) (Rauf, Wijaya & Tari, 2021). More dynamic, engaging, and customized learning experiences are made possible by these advancements. For example, business students can now use their theoretical knowledge in real-world circumstances through virtual business simulations (Solomon, Alabduljader & Ramani, 2019). Additionally, internet resources and cloud-based applications give students access to current information and facilitate collaborative learning across regional boundaries. In addition to improving educational quality, the introduction of these digital tools helps students get ready for the technological innovations they will face in the workplace.

Technology Integration and Innovation

The Nigerian University e-Learning Consortium (NUC-ELC) is a noteworthy endeavor in Nigeria that aims to encourage the integration of ICT in business education. In the wake of the COVID-19 pandemic, this consortium of Nigerian universities seeks to improve the quality and accessibility of e-learning nationwide, giving students flexible learning options (Okoro, 2021). Through the provision of digital platforms for online courses, degree programs, and resources, the consortium expands the reach of business education to include students in underprivileged and rural places. Furthermore, collaborations between academic institutions and tech companies have produced specialized curricula, such courses in digital marketing and coding, which are essential for giving students the tools they need to succeed in a business climate that has undergone a digital transformation. Additionally, by fostering the growth of ICT infrastructure, these partnerships make business education more responsive to the changing demands of the economy.

Even while these technological developments are praiseworthy, there is still a big problem with the digital divide. Particularly in rural and underdeveloped areas, access to dependable and modern ICT tools and infrastructure remains restricted (Igwe, Okolie & Nwokoro, 2021). Inadequate internet access, antiquated equipment, and a lack of teacher and student training plague many schools in these areas. Because of this, pupils in rural areas are frequently at a disadvantage when compared to their urban peers, who have greater access to technology. This discrepancy in access to digital infrastructure hinders business education's ability to fully contribute to economic development and exacerbates educational inequality (Dana, Ratten & Honyenuga, 2018). The disparity between students in urban and rural areas may keep growing if these discrepancies are not addressed, which would increase social and economic inequality.

Government, business, and academic institutions must collaborate to improve digital access and inclusivity in business education in order to prevent this result. Prioritization should be given to projects like offering reasonably priced internet access, outfitting schools with cutting-edge computers and digital resources, and educating educators on ICT usage. The digital divide may also be closed with the support of laws that encourage public-private partnerships to construct ICT infrastructure in underprivileged communities (Rashid, 2019). Nigeria can only guarantee that all

students, regardless of geography, have the chance to take advantage of the developments in business education by guaranteeing fair access to technology.

Policy and Institutional Support

Nigerian government organizations have actively shaped and supported business education through a number of programs meant to raise the standard and accessibility of the subject. A number of initiatives have been started by the Federal Ministry of Education to improve business education at the secondary and tertiary levels in partnership with the National Commission for Colleges of Education (NCCE), the National Board for Technical Education (NBTE), and the Tertiary Education Trust Fund (TETFund) (Ubogu, 2020). Comprehensive curriculum reviews to guarantee that business education stays relevant to the demands of the labor market, teacher retraining programs to increase the quality of instruction, and infrastructure grants to upgrade educational institutions' facilities and resources have all been important initiatives. These initiatives demonstrate the nation's dedication to developing a workforce with the skills necessary to propel economic growth. International partnerships with institutions such as the World Bank and UNESCO have further strengthened these efforts by lending financial and technical assistance to improve the capabilities of Nigeria's business education system.

Nevertheless, inconsistent execution and bureaucratic delays frequently undermine the efficacy of policy measures. Although a number of projects have been started, their long-term effects are limited by a lack of consistent funding and coordination at multiple governmental and institutional levels (Ekpenyong & Nwabuisi, 2003). Administrative bottlenecks and the slow pace of policy implementation frequently make it impossible to implement infrastructure upgrades, teacher development initiatives, and curriculum modifications on time. Because of this inefficiency, the full potential of these interventions has not been realized, even if policies and frameworks are available. Increased accountability and openness in the distribution and utilization of resources, as well as a more efficient and coordinated approach to policy implementation, are required to solve these issues (Nwambam, Nnennaya & Nwankpu, 2018).

Future Prospects and Recommendations

The following tactics are suggested in order to increase the influence of business education in Nigeria:

Curriculum Reform: Aligning educational content with changing labor market demands through frequent interactions with industry stakeholders, such as employers, business executives, and professional associations, is crucial to ensuring that business education stays relevant. This strategy will enable a more flexible and dynamic curriculum that gives students the information and abilities needed by today's workforce, promoting employability and creativity.

Teacher Training and Welfare: Maintaining high instructional standards and making sure that teachers remain current with teaching approaches and industry developments need investments in business education teachers' ongoing professional development. Furthermore, establishing alluring incentive programs that offer competitive pay, chances for career progression, and professional recognition can aid in keeping talented teachers in the sector and draw in fresh talent for business education.

Public-Private Partnerships: By bringing in corporate knowledge, practical ideas, and funding for curriculum creation, infrastructure, and student internships, public-private partnerships can significantly improve the caliber and applicability of business education programs. Working together with the private sector will guarantee that students have the most recent information and abilities that meet employers' demands, increasing the employability of graduates.

Technology Deployment: Bridging the digital divide and guaranteeing that all students have the chance to acquire the digital skills required for today's business environment require increasing access to ICT tools and training, especially in underprivileged areas. Nigeria can equip its business education system to match international standards and get students ready for the demands of the workforce in the twenty-first century by giving schools access to digital learning platforms, dependable internet connectivity, and current computing tools.

Monitoring and Evaluation: To evaluate the success of business education programs and make sure they are producing the intended results, strong monitoring and evaluation (M&E) frameworks must be put in place. To accomplish national and international education goals, regular M&E processes will yield data to inform policy changes, enhance program delivery, and guarantee that educational resources are being used effectively.

Conclusion

In Nigeria, business education has the capacity to significantly improve both individual empowerment and the country's long-term economic progress. Even while curriculum development and institutional growth have made significant strides, obstacles like antiquated teaching strategies, inadequate infrastructure, and a lack of industry-academic cooperation continue to impede progress. A multi-stakeholder strategy involving the government, academic institutions, business executives, and civil society is crucial to realizing its full potential. Nigeria can revive its business education industry by embracing innovation, encouraging entrepreneurship, and fusing local demands with international best practices. Business education will be positioned as a crucial pillar in Nigeria's larger socioeconomic development strategy as a result of this change, which will also provide graduates with pertinent skills and nurture a generation of job creators and business leaders.

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DIGITAL PRESERVATION OF UNIVERSITY RECORDS USING EMERGING TECHNOLOGIES: A SURVEY OF STAFF OF ESTABLISHMENT UNITS' LEVEL OF AWARENESS, READINESS AND ADOPTION IN UNIVERSITIES IN THE SOUTH-SOUTH REGION OF NIGERIA

¹Lovet Ovigie Esievo (PhD) & ²Ebikabowei Emmanuel Baro (PhD)

¹Federal University of Agriculture Zuru, Zuru. Kebbi-State, Nigeria

²Federal Univesity Otuoke, Bayelsa State, Nigeria

elcomesievo@gmail.com

Abstract

This survey study was designed to investigate the digital preservation practices in establishment units in universities in Nigeria. The study adopted survey method. Quantitative and qualitative data was collected from staff of Establishment Units of universities. Data was collected from 20 universities from the South-South of Nigeria. An online questionnaire was designed using Google form, the link to the online questionnaire was forwarded to the staff of Establishment units. Questionnaire and interview methods were used to collect data from 54 staff members working in establishment units in 20 universities in the South-South. To supplement the data collected from the questionnaire, some of the establishment units' leaders were interviewed. The results show that the respondents are aware of using some emerging technologies to preserve records while they are not aware of some other emerging technologies to preserve records. The results clearly show that more than half of the respondents are very highly and highly prepared to adopt emerging technologies to manage university records. The results show that provision of fund for digital preservation of university records and effective endorsement of record management projects were rated to be moderate in their universities by more than half of the respondents. Support training of staff and approval of policies for digital records management were rated to be low in their universities by more than half of the respondents. The adoption of emerging technologies preserve university records is to achieve long time preservation of vital files in the event of any natural disaster like flood, fire.

Keywords: Digital preservation, university record, online storage, university files, Nigeria.

Introduction

Digital preservation remains one of the most critical challenges facing record management today. Universities' information centers are all struggling with how to preserve the valuable records now that this information is increasingly being produced in digital formats (McLeod & Hare, 2016). Digital information is fragile and faces many threats including technological obsolescence and the deterioration of digital storage media (Li & Banach, 2011). Digital preservation applies to "born digital" material (i.e. created electronically), and to "digital surrogates" (i.e. created in non-digital form but subsequently converted to digital form). After collections or individual items are digitized, the next stage is digital preservation. The latter involves all the activities undertaken to ensure that digital information is maintained for as long as it is needed (Fabunmi et al., 2006). With literally every bit of information now being digitally processed and stored, our computer-based society is faced with a great challenge: How best to preserve and efficiently access these vast amounts of digital data well into the future? While born-digital content is emerging in all areas, ways to preserve it are far behind most especially for universities in Africa. Digital preservation can be defined as the combination of policies, strategies and actions to ensure access

to and accurate rendering of authenticated reformatted and born digital content over time regardless of the challenges of media failure and technological change (Noonan, 2014).

Recently, modern technologies such as blockchain, cloud computing, Internet of Things (IoT), and many others have increasingly been adopted by various organisations to manage records while other organisations are slow to adopt them (Akporhonor, 2020; Masenya, 2020; Huda et al., 2024). Writing on digital longevity, Jackson (2011) states that, “the rate of change in computing technologies is such that information can be rendered inaccessible within a decade” (p. 2). Preservation has taken a new dimension with modern electronic technology. To this end, digitization of important materials that may deteriorate because of age and condition is being carried out by information professionals. Several studies have also identified key problems with records management, including poor or non-existent of training related to the use of digital technologies for the management of digital records (Mthembu & Ocholla, 2019). File cabinet storage proved to be inefficient use of space and this may explain why universities have not been able to save and preserve more records for future access (Akporhonor, 2020). Preservation of records in universities for future retrieval has been a challenge to universities in Nigeria. It was observed that records of staff of universities are difficult to trace after a period of time. Effective management of staff records becomes an important issue over the past years. For this reason, the present study aimed to investigate digital preservation of university records using emerging technologies in universities in Nigeria.

Research questions

1. To what extent are the establishment unit staff aware of using emerging technologies to preserve university records?
2. How are records managed in the establishment unit of the university?
3. What is the level of staffs’ readiness in terms of ICT infrastructure to adopt emerging technologies for record management?
4. What emerging technologies are being adopted in your university to manage records?
5. What is the level of digital skills possessed by the staff of the establishment units in the university?
6. To what extent do management support influence adoption of emerging technologies for record management?

Literature review

The literature will be discussed under the following sub-headings: digital preservation, record management, key aspects of university record preservation, artificial intelligence, data analytics, internet of things technology, and blockchain technology.

Digital preservation

Digital preservation involves all the activities undertaken to ensure that digital information is maintained for as long as it is needed (Fabunmi et al., 2006). Digital preservation is a significant problem facing universities in Nigeria. Universities are struggling to preserve the scholarly and cultural records now that this information is increasingly being produced in digital form. Digital information is fragile and faces many threats; among them are technological obsolescence and the deterioration of digital storage media. Writing on digital longevity, Jackson (2011) states that, “the rate of change in computing technologies is such that information can be rendered inaccessible within a decade” (p. 2). Preservation has taken a new dimension with modern electronic technology. The growth coupled with ongoing technological innovations is driving a qualitative change in the way individuals, organizations, institutions, and governments are run. This can be illustrated by the way technology has transformed data storage. Besides, information and

communication technologies (ICT) are producing information in new ways thanks to office automation and other digitalized mechanisms (Adade, Quashigah & Eshun, 2018).

Record Management

According to Bakare (2016), records management can be defined as a management discipline that is crucial in regular control of records creation, usage, maintenance and its final disposition. Phiri and Tough (2018) reported that although paper records and documents were predominant in Malawi universities, record keeping was increasingly becoming digital. Personal computers were becoming a common sight in the offices, and local area networks were present in some designated departments. The universities were increasingly making use of digital records (Phiri & Tough, 2018). In the case of universities, records are created periodically. The quality of their record keeping in the record units is pivotal in determining the success or failure of those institutions. They must use their data effectively and efficiently, and use it to their best advantage (Mukred et al., 2019).S

Key Aspects of University Record Preservation

Huda et al. (2024) outlined the following as some of the major aspects of university record preservation

Preservation in physical format: This involves ensuring records are stored in a stable environment, free from pests, water, heat, and other elements that can cause deterioration. Techniques involves removing items like staple pins and paper clips, straightening pages, and avoiding the use of certain labels or mending devices that can damage records.

Preservation in digital form: This involves maintaining the integrity and accessibility of digital records, ensuring their long-term storage, and migrating them to new formats as technology evolves. This often involves using electronic document and record management systems (EDRMS) and ensuring proper backups and data recovering procedures.

Access and Use: university records, especially those in archives are often made available to the public for research and historical purposes. However, access may be restricted for confidential or sensitive records.

With the rapid pace of technological advancement, it's no surprise that the records management industry is experiencing significant changes, too. Below are some of the latest IT trends and how they impact records management:

Cloud Computing

One solution that has gained popularity in recent years is the adoption of cloud computing technology (Ali et al., 2021). Cloud computing has emerged as a transformative technology with the potential to revolutionize various sectors, including university records. As institutions grapple with the increasing digitization of resources and the need for scalable, cost-effective solutions, awareness of these emerging technologies becomes crucial. Using cloud computing, universities are able to overcome the limitations of physical infrastructure and leverage the benefits of storing and accessing data in a virtual environment. Cloud computing offers numerous advantages to university settings, such as improved accessibility, scalability, cost-effectiveness, and information sharing (Kayode, 2020). This technology allows libraries to leverage the power of remote servers, storage facilities, and applications to effectively manage and preserve their digital records. With the use of cloud computing, universities can store and access a large volume of digital records, eliminating the need for extensive physical storage space. The storage and access to digital records

from anywhere at any time, eliminating the need for physical storage space and reducing costs associated with maintenance and upgrades.

Cloud computing is one of the most significant IT trends that has revolutionized the way records management is conducted. With cloud computing, records can be stored in a central location that's accessible from anywhere with an internet connection. This has improved collaboration, increased productivity, and reduced costs associated with traditional document storage methods. Additionally, cloud computing has made it easier for records managers to ensure compliance with regulatory requirements, as records can be easily audited and tracked (Huda, et al. 2024). Cloud computing is an emerging technology that can be used to manage university records and it consists of on-demand computing services delivered over the internet from a remote location or via an organisation's servers (InterPARES 2016). Cloud computing has the potential to reduce costs while increasing value by allowing the more efficient use of IT resources, and fewer staff, hardware and software resources are required to support the enterprise.

Artificial Intelligence

Artificial intelligence (AI) is among the emerging technologies that are transforming the records management industry. AI tools can analyse large amounts of data, identify patterns, and provide insights that help organizations make informed decisions. For example, AI-powered software can help records managers identify duplicate records, classify documents, and automate record retention and disposition schedules (Huda, et al. 2024). This has resulted in improved efficiency and accuracy of records management processes. Modiba (2025) examined the adoption of artificial intelligence (AI) to enhance records management practices at the Gauteng Department of Education, South Africa and found that AI can proficiently and effectively execute all records management practices across the entire records lifecycle.

Data Analytics

Upwards of 3.5 quintillion bytes of data are being created every day. With such an insanely large amount of data being generated, records managers must find ways to extract meaningful insights from this data. Data analytics tools can help records managers analyse large amounts of data to identify IT trends, patterns, and anomalies (Huda, et al. 2024). This can help organizations make better decisions and improve their records management processes.

Internet of Things Technology

Another emerging technology for managing records is the Internet of Things, a dynamic and global network infrastructure, in which "Things" are expected to communicate among themselves and interact with the environment by exchanging data generated by sensing, while reacting to events and triggering actions to control the physical world (Liu, 2015). Badimo (2017) describes IoT as the general idea of physical objects that are seamlessly integrated into the information network, that are readable, recognisable, locatable, addressable and controllable via the internet. According to Badimo (2017), the IoT is at the core of digital transformation with 73 per cent of executives either researching or currently deploying this technology. This technology can assign heightened security levels to the documents with the ability to recognise confidential documents and prevent unauthorised access to digital records.

Blockchain Technology

Blockchain technology is a decentralized digital ledger that can be used to secure record transactions which is relatively new as far as information technology trends go but has the potential to greatly impact records management. Records managers can use it to ensure the authenticity and integrity of records. For example, blockchain technology can be used to track the

chain of custody for records and ensure that records have not been tampered with (Huda, et al. 2024). Deloitte (2016) describes a blockchain as a distributed ledger of all transactions, which are recorded in discrete blocks and linked together in a chain, and each block contains private data and a public header that is used to link to the next block on the chain. Blockchain comprises data records or blocks, and once these blocks are collected in a chain, they cannot be changed or deleted by a single actor; instead they are verified and managed using automation and shared governance protocols (Blockgeeks 2016). The blocks are sequentially linked and cryptographically secured in such a way that only the owner of data in a block can unlock it using their private key (Straw, 2016). Shaw (2016) further describes blockchain technology as a shared electronic database in which the data records are immutable and encrypted, and these data records can be shared within a group of people, organisations or a community. The shared document is encrypted and verified to ensure that the data it stores is always correct and every record added to the blockchain ledger has a unique key associated with it that can be trusted (Shaw, 2016).

With regard to records management, blockchain technology has the potential to impact all records management processes and extend their capabilities, and it also has broad implications for securing and authenticating intellectual property at a lower cost and higher efficiency (Gartner 2016). Blockchain can also help universities in digitising existing records and manage them within a secure infrastructure (Gartner 2016). Once digital information is committed onto a blockchain, it is permanently stored and impossible to manipulate or hack. This technology has a tracking system to ensure the integrity of data at all times. Mohammadi and Noruzi (2023) studied the blockchain technology: Benefits and applications in healthcare information systems. The study found that Blockchain technology as a regulatory technology that can enhance healthcare information services by bringing high-quality healthcare services in a crystal-clear view that is decentralized, immutable, tamper-resistant, flexible, traceable, and secure. It also enables clinical professionals to effectively detect vulnerabilities and cyber invasions related to patients' health information. A move from file cabinet storage systems towards the digital management systems was never painless. Proper management of university records continues to be a challenge due to a lack of sufficient skills, policy, procedures and standards, as well as a lack of knowledge of how to utilise modern technologies in managing university records. University records continue to increase in multiple formats and if they are not properly managed, there can be a delay or no access to these records after some years. Therefore, the more efficient the management of university records, the more effective access is provided.

Methodology

The study adopted survey method. Quantitative and qualitative data was collected from staff of Establishment Units of universities. Data was collected from 20 universities from the South-South of Nigeria. An online questionnaire was designed using Google form, the link to the online questionnaire was forwarded to the staff of Establishment units. The reason for choosing the establishment unit staff is because the unit is responsible for the university record keeping in all universities. the email addresses were collected from the university websites. In total, 54 staff of the establishment units of the various universities responded to the survey. To supplement data collected using questionnaire, Heads of Establishment units were engaged in an interview. The interview was done separately with the informants using email. The responses from the interview are in-cooperated into the dissuasion session. Results are presented in tables and charts.

Results

Table 1: Universities that responded with no. of respondents from the Establishment units.

s/n	Name of university	State	Status	No. of respondents
1	University of Port-Harcourt, Port-Harcourt	Rivers State	Federal	3
2	University of Calabar, Calabar.	Cross River State	Federal	4
3	University of Benin, Benin City.	Edo State	Federal	4
4	University of Uyo, Uyo.	Akwa Ibom State	Federal	3
5	Delta State University, Abraka	Delta State	State	2
6	Federal University of Petroleum Resources, Effurun	Delta State	Federal	2
7	Ambrose Alli University, Ekpoma	Edo State	State	3
8	Niger Delta University, Wilberforce Island, Yenagoa.	Bayelsa State	State	2
9.	University of Cross River, Cross River.	Cross River State	State	4
10	Rivers State University, Port Harcourt	Rivers State	State	3
11	Edo State University, Uzairue	Edo State	State	2
12	Federal University, Otuoke	Bayelsa State	Federal	3
13	Akwa Ibom State University, Ikot- Akpaden.	Akwa Ibom State	State	2
14	Igbinedion University, Okada, Benin City.	Edo State	Private	2
15	Madonna University, Elele	Rivers State	Private	2
16	Benson Idahosa University, Benin City.	Edo State	Private	3
17	Nigerian Maritime University, Okerenkoko	Delta State	Federal	2
18	University of Africa, Toru-Orua.	Bayelsa State	State	3
19	PAMO University of Medical Sciences, Port-Harcourt.	Rivers State	Private	2
20	Novena University, Ogume	Delta State	Private	3
	Total			54

Staff designation

The results in Table 2 shows that the highest number of respondents indicated as Executive Officers (EO) with 12 (22.2%) staff, followed by Chief Executive Officers (CEO) with 9 (16.7%) staff, and Administrative Officer (AO) with 8 (14.8%).

Table 2: Distribution of respondents by staff designation from the 20 universities

Staff designation	No. of respondents	Percentage
Deputy Registrar (DR)	6	11.1
Senior Assistant Registrar (SAR)	3	5.6
Assistant Registrar (AR)	4	7.4
Administrative Officer (AO)	8	14.8
Chief Executive Officer (CEO)	9	16.7
Assistant Chief Executive Officer (ACEO)	7	13.0
Principal Executive Officer (PEO)	5	9.2
Executive Officer (EO)	12	22.2
Total	54	100%

The staff awareness of using emerging technologies to preserve records

Respondents were asked to indicate their awareness of using emerging technologies to preserve records. The majority (40: 70.1%) of the staff indicated that they are aware of using cloud computing to preserve records. The majority (41: 75.9%) indicated that they are not aware of using Artificial Intelligence (AI) to preserve records. More than half (32: 59.3%) of the respondents indicated that they are not aware of using Data Analytics to preserve records. More than half (35:

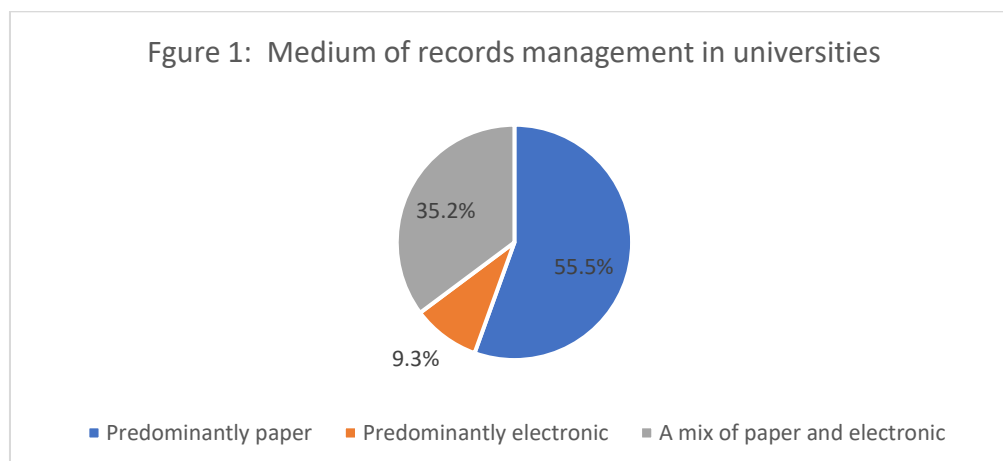
64.8%) also indicated that they are aware of using Internet of Things technology (ToTs) to preserve records. The majority (46: 85.2%) of the staff indicated that they are aware of using Mobile Devices to preserve records. The majority (38: 70.4%) of the staff indicated that they are aware of using Blockchain Technology to preserve records (Table 3). The results show that majority of the respondents are aware of using emerging technologies such as Cloud computing, Mobile Devices, Blockchain Technology, to preserve records while majority are not aware of using emerging technologies like Artificial Intelligence, Data Analytics, and Internet of Things technology to preserve records.

Table 3: Awareness of using emerging technologies to preserve university staff records.

Emerging technologies	Aware	Not aware
Cloud computing	40 (70.1.0%)	14 (25.9%)
Artificial Intelligence	13 (24.1%)	41 (75.9%)
Data Analytics	22 (40.7%)	32 (59.3%)
Internet of Things technology	19 (35.2%)	35 (64.8%)
Mobile Devices	46 (85.2%)	8 (14.8%)
Blockchain Technology	38 (70.4%)	16 (29.6%)

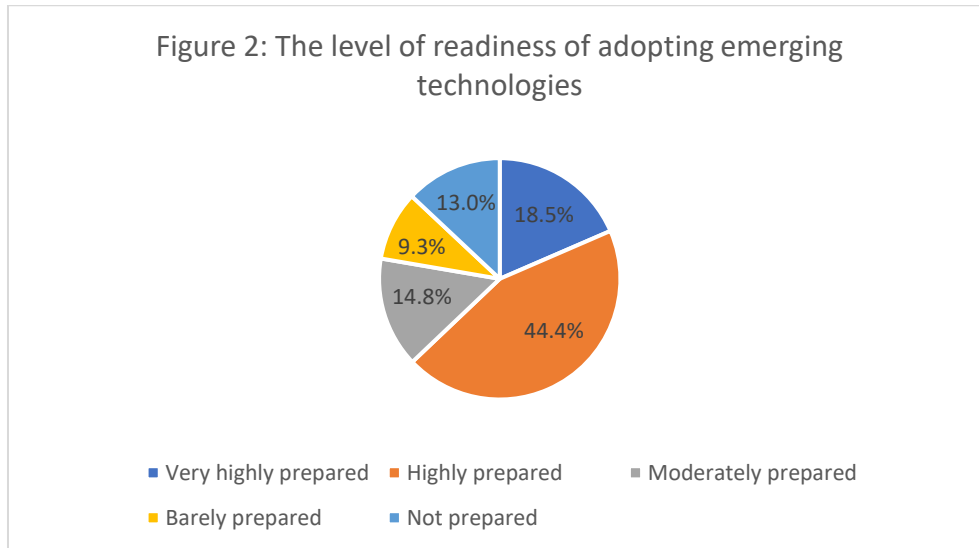
How records in the establishment unit of the university are managed

Respondents were asked to indicate the medium through which records are preserved in their university establishment unit. More than half (30:55.5%) indicated that records are preserved predominantly in paper form in their university establishment unit. Only 5 (9.3%) respondents indicated that records are preserved predominantly in electronic form. While, 19 (35.2%) respondents indicated that records are preserved both in paper and electronic form (Figure 1). The results show that many of the universities studied are still preserving their records only in paper form.



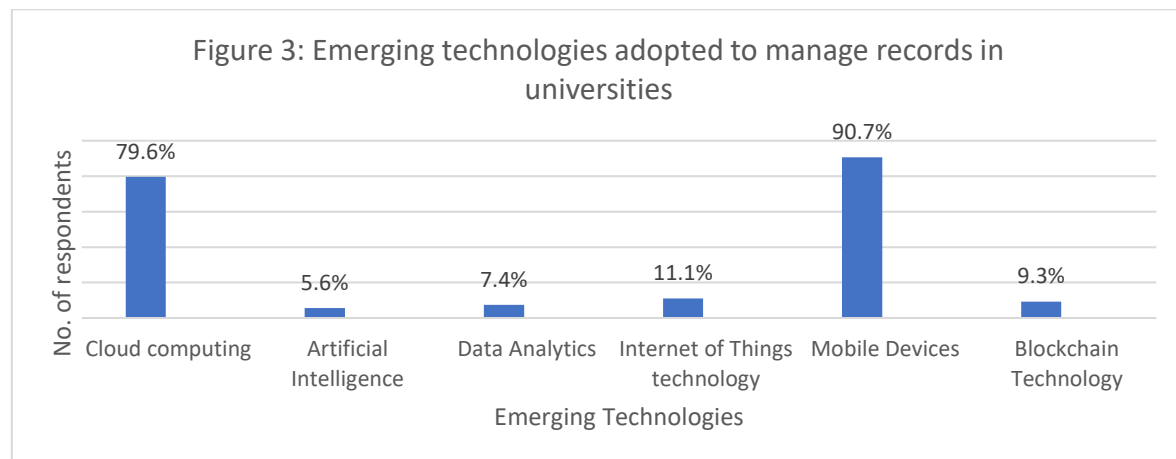
Readiness in terms of ICT infrastructure to adopt emerging technologies

Respondents were asked to indicate how ready they are in terms of ICT infrastructure to adopt emerging technologies in university staff records preservation. Almost half (24: 44.4%) of the respondents indicated they are highly prepared, followed by 10 (18.5%) respondents who said they are very highly prepared, 8 (14.8%) respondents indicated that they are moderately prepared, 5 (9.3%) indicated they are barely prepared. While, 7 (13.0 %) respondents indicated that they are not prepared to adopt emerging technologies to manage university records (Figure 2). The results clearly show that more than half of the respondents are very highly and highly prepared to adopt emerging technologies to manage university records.



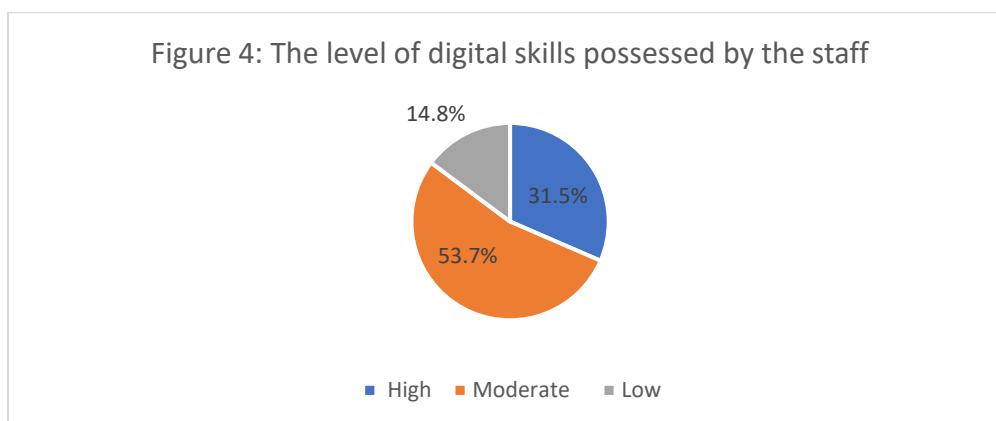
Emerging technologies adopted to manage records in universities.

The respondents were asked to indicate the type of emerging technology adopted in their university to preserve records. They were asked to select as many that apply. Almost all (49: 90.7%) indicated that they have adopted mobiles devices to preserve records. The majority (43: 79.6%) also indicated that they used Cloud computing to preserve records. Only few indicated using Internet of Things technology (6:11.1%), Blockchain Technology (5:9.3%), Data Analytics (4:7.4%), and Artificial Intelligence (3: 5.6%) (Figure 3). The results show that majority of the universities have only adopted using cloud computing and mobiles devices to preserve university records.



The level of digital skills possessed by the staff of the establishment units in the university

The respondents were asked to rate themselves on digital skills possessed to use emerging technologies. More than half of the respondents rated their skills to be moderate (29: 53.9%), followed by 17 (31.5%) respondents who rated their skills to be high, while 8 (14.8%) rated their skill level to be low (Figure 4). The results show that more than half of the respondents rated their digital skills possessed to manage university records to be moderate.



Extent management support to adopt emerging technologies

Results in Table 4 revealed that more than half (31: 57.4%) of the respondents indicated that provision of fund for digital preservation of university records is moderate in their university, and effective endorsement of record management projects is also moderate (28:51.8%) in their university. While, more than half (33: 61.1%) of the respondents indicated that supporting training of staff is low, and more than half (28: 51.9%) of the respondents indicated that formulate and approval of policies for digital records management in their university is low. The results show that provision of fund for digital preservation of university records and effective endorsement of record management projects were rated to be moderate in their universities by more than half of the respondents. While, support training of staff and approval of policies for digital records management were rated to be low in their universities by more than half of the respondents.

Table 4: Extent of management support to adopt emerging technologies for record management

Statements	High	Moderate	Low
Provision of fund for digital preservation of university records	8 (14.8%)	31 (57.4%)	15 (27.8%)
Effective endorsement of record management projects	17 (31.5%)	28 (51.8%)	9 (16.7%)
Support training of staff	9 (16.7%)	12 (22.2%)	33 (61.1%)
Formulate and Approval of policies for digital records management	10 (18.5%)	16 (29.6%)	28 (51.9%)

Discussion of Findings

Awareness of using emerging technologies to preserve records

Regarding awareness of using emerging technologies to manage university record, the results show that the respondents are aware of using some emerging technologies to preserve records while they are not aware of some other emerging technologies to preserve records. An interview one of the Head of Establishment unit – *I am aware of the modern technologies used to manage records*. Another mentioned – *I have heard of using so many emerging technologies like Cloud computing, google drive, OneDrive, Blockchain and others*. This implies that the establishment units staff stay abreast of new trend and evolving emerging technologies in their work. This can easily lead to the adoption of this tools in various universities. This indicates a proactive approach by the university staff in staying updated with emerging technologies, which can potentially lead to widespread adoption in the universities.

Medium of managing university records in the establishment units

The results show that many of the universities studied are still preserving their university records predominantly on paper. Interview with few Heads of Establishment confirm that majority of the university records are still preserved in paper form. For example, one Head of Establishment unit said – *we have not adopted emerging technologies to manage our university records, we plan to do that soon*. The results show that many of the universities in the south-south are yet to embrace emerging technologies to digitally preserve their records. This finding is in line with the findings of Phiri and Tough (2018) that among the universities surveyed, in South Africa and Malawi, paper records and documents were predominant in Malawi universities, record keeping was increasingly becoming digital.

Readiness in terms of ICT infrastructure to adopt emerging technologies for record management

The results clearly show that more than half of the respondents are very highly and highly prepared to adopt emerging technologies to manage university records. From the interview one Head of Establishment Unit mentioned – *we are read to adopt the new emerging technologies to manage our records because they will preserve the records for long time and allow for easy access*. Another mentioned - *our university is working towards adopt some of these emerging technologies to preserve our records*. Concerning readiness in terms of infrastructure, one Head of Establishment mentioned – *we are ready but first our university is working on getting stably internet connectivity, once that is achieved, the next is to adopt some of the electronic platforms to preserve our records*. The results show that the establishment units' staff of the universities are ready to embrace the emerging technologies and need constant internet connectivity. On a contrary note, the present findings disagree with the findings of Chepkwony (2015) who looked at accessibility to network infrastructure, capacity building and staff levels of education influence adoption of Electronic Medical Records technology by healthcare organisations in the County of Nairobi, Kenya and found that there exists no significant relationship ($r=0.673$ and $p=0.045$) between accessibility to network access and adoption of EMR in public health facilities in Nairobi county. Slow or intermittent internet connections can disrupt workflows, impede access to digital collections (Fried, Greenwood & Chatnik, 2023).

Emerging technologies adopted to manage records in universities

The results show that majority of the universities have only adopted cloud computing and mobiles devices to preserve university records. This shows that adopting emerging technologies is still at a slow pace in universities in the South-South, Nigeria. One Head of Establishment Unit mentioned – *we have modern computers, cloud computing storage is in place in our university and we are planning to adopt other emerging technologies like internet of things (ToTs)*. Another Head of Establishment Unit mentioned – *we are presently working on implementing Electronic Document management system (EDMS) to preserve our university e-records for long term access*. The presence of all this ICT infrastructure raises prospects for the thriving of e-records in public universities in Nigeria. The computers would help in creation, receipt, storage and even transmission of e-records via the robust network available. Miss (2021) supported this by highlighting the high level of adoption of cloud computing within Nigerian libraries and highlights its use to aid library services. Furthermore, Yakubu et al. (2023) review empirical studies of cloud computing adoption in academic libraries in anglophone West African countries, indicating a significant uptake for collaboration and resource sharing. The development of modern technologies is therefore imperative to pinpoint issues pertaining strategies for management of university records in the university environment.

The level of digital skills possessed by the staff of the establishment units in the university

The results show that more than half of the respondents rated their digital skills possessed to manage university records to be moderate. This shows that the staff need training on managing

university records using emerging technologies. For example, one Head of Establishment Unit mentioned – *I am digitally literate, I can use new technology, but still need training on skills to preserve records using technologies like Internet of Things (ToTs), Blockchain, and other.* The results show that staff deployed to the establishment units did not have the needed skills in digital records management. Poor funding and lack of proper training for digital records management could negatively impact the e-records management function in the universities in Nigeria. The effective management of records depend on staff receiving adequate records management training to enable them to acquire knowledge and skills needed to successfully manage and preserve their digital records. Kemoni and Ngulube (2007) recommended that in order to raise the profile of records management, staff in the registries should be recruited and deployed on the basis of their records management qualifications and experience. Ndenje-Sichalwe (2010) also recommends the provision of a higher level of training in digital records management among the registry staff through short courses, workshops and seminars.

Extent of management support to adopt emerging technologies

The results show that more than half of the respondents rated provision of fund for digital preservation of university records and effective endorsement of record management projects to be moderate in their universities. While, support training of staff and formulate and approval of policies on digital records management were rated to be low in their universities by more than half of the respondents. One Head of Establishment Unit highlighted this when she said - *release of fund is a major challenge in this university. Request for funds for training of staff in my unit have been raised several times but each time you are told there is no money. That is what is pulling us down.* Limited budgets may prevent institutions from investing in cloud infrastructure, software licenses, and staff training programs (Martin, 2020).

The study found that management supporting training of staff is low. Confirming this, one Head of Establishment Unit said *“I have been on this job since the university opened 2012, but I have never been sent on any [formal] digital records management training.”* Recruitment of personnel with other qualifications other than digital records management to manage e-records could be attributed to a lack of an e-records management policy or indeed existence of a staff development policy that fails to clearly identify the training needs of records management personnel. A related study focusing on the Southern African Region was carried out by Bigirimana et al. (2015) at the Africa University based at Mutare in Zimbabwe, aimed at assessing the effectiveness of e-records management. Findings of the study showed that e-records management policies formulation and approvals are low in the universities. The finding of the present study agree with the findings of Chaputula, (2022) that all the three universities covered by this study (Mzuzu University (Mzuni), Malawi University of Science and Technology (MUST), and Malawi University of Business and Allied Sciences (MUBAS) did not have specific policies that governed the management of e-records. Training for e-records management staff is critical as it empowers them with the necessary knowledge and skills to enable them to properly discharge their duties. Lack of frequent professional development programmes for records management staff means that most of them will be ill-prepared to manage e-records in the institutions studied. These findings reflect results of previous studies. It is worthy of note that senior management support is a key driver for effective digital preservation of university records and documents as it is responsible for providing human and financial resources to effectively manage records and documents. Malanga and Kamanga (2019), for instance, observed that e-records management at Karonga District council in Malawi was marred by a failure to adhere to policies and standards while the infrastructure that was meant to support e-records management was lacking. The study by Mukred et al. (2016) focused on the development of an electronic records management system (ERMS) adoption readiness framework for higher professional education (HPE) institutions in Yemen. Findings revealed that successful

promotion of effective ERMS readiness among HPE institutions in Yemen would require a clear policy for an ERMS, sufficient IT infrastructure, implementation of security practices, conducting training for the personnel involved in using and maintaining the system, and allocation of a financial budget to cover the successful implementation of the ERMS.

Conclusion

The results revealed that the staff of establishment unit are aware of some emerging technologies and not aware of others. They have adopted emerging technologies like cloud computing, mobile device to preserve university records. They rated their skills to use emerging technologies to be moderate. support training of staff and formulate and approval of policies on digital records management were rated to be low in the universities. The rapid evolution of IT has brought significant changes to the records management industry. The adoption of cloud computing, artificial intelligence, data analytics, mobile devices, and blockchain technology will revolutionised the way records are stored, analysed, and managed. Therefore, it has become imperative for all universities to embrace these emerging technologies to achieve long term preservation of university records.

Recommendations

1. The staff of the establishment units in the universities need to stay informed about the latest developments in emerging technologies for record management and be open to adopting new tools and systems.
2. Universities should support the staff of establishment unit through trained in use of new systems and understands the best practices in record management.
3. Universities should support by making policies regarding record management in the digital era using emerging technologies.

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EFFICACY OF ADAPTIVE PERSONALIZED DIGITAL LEARNING PLATFORM ON INTEGRATED SCIENCE AND PHYSICS EDUCATION STUDENTS' UNDERSTANDING OF ENERGY IN UNIVERSITY OF LAGOS, NIGERIA

Veronica Folasade Titilayo Babajide (Ph.D)

Department of Science Education,
University of Lagos, Lagos Nigeria.
vbabajide@unilag.edu.ng

Abstract

This study investigated the impact of adaptive personalized digital learning platform on Integrated Science and Physics Education students' understanding of Energy at the University of Lagos, Nigeria. The growing demand for technology and artificial intelligence in all sectors and in the sector of education in particular, underscore the need for the study on the effect of the adaptive personalised digital learning platform on the understanding (conceptual comprehension, academic performance and achievement) of integrated science and physics education students in the concept of energy in a course titled energy and force an undergraduate course in university of Lagos, Nigeria. The study adopted a pre-test, post-test, control group quasi-experimental design, involving two cohorts of undergraduate Integrated Science and physics education undergraduate students selected using simple random technique, with the experimental group exposed to adaptive personalized digital learning interventions and the control group taught with conventional lecture method. Items used were validated with a reliability coefficient of .743 (Parallel model Correlation) obtained from undergraduate students' scores. After a six-week treatment, data collected from the 49 undergraduates Integrated and physics education students, were analysed, using descriptive statistics of mean and standard deviation, to provide answers to research questions and inferential statistics of independent Samples Test and Analysis of variance (ANOVA were) used to test the stated hypotheses. Results revealed that students in the Adaptive personalized digital learning platform group demonstrated significantly higher gains in physics understanding and expressed greater engagement and satisfaction with the learning process.

Keywords: Adaptive Personalized Digital Learning, integrated science, Physics education

Introduction

The integration of technology in education has become increasingly prevalent in recent years, transforming the way students learn and interact with complex concepts. Jugembayeva and Murzagaliyeva (2022) noted that digital learning platforms have emerged as a promising tool for enhancing student outcomes, particularly in subjects like physics that require a deep understanding of abstract concepts and principles. Physics, as a fundamental discipline, plays a crucial role in shaping the understanding of the natural world and driving technological innovations. However, Zou, Kuek, Feng and Cheng (2025) submitted that teaching and learning of physics can be challenging due to its abstract nature, requiring students to develop a strong foundation in mathematical and scientific principles. In Nigeria, and across the globe, the importance of science education, including physics, cannot be overstated. The significance of science and technology in driving economic growth, improving healthcare, and addressing societal challenges are greatly recognized. As a result, faculty of education in Nigerian universities offer various science education programs, including integrated science education, physics education, biology education, chemistry education and mathematics education for the training of science teachers in the

respective areas of science to teach at the secondary school levels in Nigeria and at high school in the western world.

The University of Lagos, one of the top rated institutions in Nigeria, and known for her strong reputable academic excellence, offers the above courses for the training of science teachers. Two of the physics education courses offered by integrated science and physics education students are STI 213 (Physics in Integrated science a first semester course compulsory for 200 level integrated science education students and elective for 200level physics education students. The second of the physics education course in integrated science courses is STI 324 (Energy and force in Integrated science which is a second semester and a compulsory course for 300level integrated science education students but elective for physics education students. This course equipped student teachers in training at the university level on the rudiments of energy and force and its applications so as to teach the concept of energy and force as well as its applications to science students at the secondary school level effectively. This study therefore focused on STI 324 because it's the most relevant physics course in integrated science at the time of which this study is conducted. The concept of energy and its application runs for the first six weeks while the concept of force and its application runs for another six weeks. Since this study lasted for a period of six weeks and the administration of treatment lasted for six weeks, the study focused on energy and its applications. This justified the focused area of the study. For the teaching of these concepts to be effectively taught, science students at the university level need to adequately be prepared using adaptive personalised method of instruction such as adaptive personalised digital learning platform because of the current era of digitalisation the world is presently witnessing.

Physics is often perceived as difficult subject to students at all levels, despite its importance, Ayeshung (2024) noted that Nigerian students often struggle with physics concepts, leading to poor academic performance and a lack of interest in the subject. Several factors contributed to these challenges, including inadequate teaching methods, insufficient resources, and a lack of personalized attention offered by the traditional method of instruction. This teaching approach often fails to cater to individual students' needs, abilities, and learning styles, resulting in an approach that can hinder student progress. Also, because of poor background of students in integrated science, which may be accounted for by the avoidance of the physics aspect of integrated science by the teachers at that level because of their poor knowledge in this aspect. Hence, there is the great need to prepare integrated science students and physics education students at the university level to adequately teach the physics aspect of the subject that is problematic at the secondary schools to catch them young and prepare the students to pick up physics and its related subject and offer it at the senior secondary school using adaptive personalised digital learning platform, probably, there will be improvement on the knowledge acquired on the concepts of physics such as energy and its applications that are problematic to teach in integrated science at the secondary school level.

The advent of digital learning has, no doubts, opened up new possibilities for addressing these challenges. This is because digital learning platforms can provide interactive simulations, real-time feedback, and adaptive assessments, allowing students to engage with physics concepts in a more immersive and dynamic way (Pokhrel, 2024). These platforms can also offer personalized learning experiences tailored to individual students' needs, abilities, and learning styles. By leveraging digital learning, educators can create learning environments that cater for the diverse needs of their students, potentially leading to improved academic outcomes and increased student engagement.

Personalized learning, in particular, has gained significant attention in recent years. This approach, as opined by Winarno, Rusdiana, Riandi, Susilowati and Afifah, (2020), involves tailoring the

learning experience to individual students' needs, abilities, and learning styles. Research (Ellermeijer and Tran, 2019) has shown that personalized learning can lead to significant improvements in student outcomes, including increased academic achievement, improved student engagement, and enhanced motivation. In the context of physics education, Ayeshung (2024) noted that personalized digital learning can help students develop a deeper understanding of complex concepts, improve their problem-solving skills, and build confidence in their abilities.

In addition to the above, several studies (Wang, Wu and Wang, 2019; Oludare, Moradeke, Rufus and Akinwimi, 2021) have explored the effectiveness of digital learning in physics education with positive results in favour of digital learning. In similar vein, Rana (2020) argue that digital learning platforms can enhance student understanding of physics concepts, improve student engagement, and increase academic achievement. However, despite these promising findings, there is still a need for more research on the effectiveness of personalized digital learning in physics concepts and education, particularly in the Nigerian context. This study therefore investigated the effectiveness of Adaptive personalised digital learning platform on the understanding of energy of integrated science and physics education students in university of Lagos using gender and mode of entry as moderator variables

The choice of selection of these moderator variables is due to the act that gender and mode of entry is still an issue in science education, specifically in physics education. Some researchers found that male students outperformed their counterpart female students in physics related courses while some obtained no significant differences in performance of male and female students in physics courses. For example, the research reports of Chen and DI (2023) found that female scientist gender differences in US and Italy are more attributed to underrepresentation of women in physics. Also, Quinn and Holmes (n.d) found that men are overrepresented in high- ranking position within physics community. While Karimi (undated) found no significance gender gap. The selection of mode of entry is due to the inconclusive results on it, for example, the research reports of Ituma et al (2023) who investigated the relationship between UTME and Post UTME scores of students in mathematics and found a significant positive relationship between the UTME and Post UTME on achievement of university students in mathematics. While Bello et al 2021 who study the comparative effect of mode of entry of undergraduate students in science education at University of Kashere, Nigeria found no significant difference between the scores of UTME and DE students in science. Hence, there is the need to further investigate empirical results of gender and mode of entry on understanding (conceptual comprehension, academic performance and achievement) of students in energy and its application which are topics in the physics course of STI 324. Note that understanding in this study is a measure of comprehension, academic performance and achievement

Literature Review

The integration of technology in education has revolutionized the way students learn and interact with complex concepts, particularly in physics. Adaptive personalized digital learning has emerged as a promising approach to cater to individual differences in learning styles, pace, and preferences. Research has shown that personalized learning can enhance student engagement, motivation, and achievement in physics (Kearns, 2018). Personalized learning systems can also provide real-time feedback, adaptive assessments, and learning analytics to inform instruction (Pokhrel, 2024).

Various digital learning platforms have been developed to support physics education, including online simulations (e.g., PhET Interactive Simulations), virtual labs (e.g., Open Source Physics), and game-based learning environments (e.g., Physics Playground). These platforms have been

found to offer interactive and immersive learning experiences that can enhance students' understanding of complex physics concepts (Zou et al., 2025).

Integrated science students often face challenges in physics due to its abstract nature, mathematical requirements, and laboratory-based learning (Winarno et al., 2020). Research has shown that these challenges can be addressed through contextualized learning approaches that relate physics concepts to real-world applications (Oludare et al., 2021). At the University of Lagos, science students may face unique challenges due to large class sizes, limited resources, and varying levels of prior knowledge and experience. Personalized digital learning can help address these challenges by providing students with flexible, self-paced learning opportunities that cater to their individual needs. Adopting personalizing digital learning for integrated science and physics education students' knowledge of physics topics has the potential to enhance student engagement, motivation, and achievement. By harnessing digital technologies, it is hopeful that educators will be able to create tailored learning experiences that cater to individual students' needs and abilities.

Research Objectives

The objectives of the study are to find out the:

1. comparative effectiveness of adaptive personalized digital learning platform over traditional lecture method on integrated science and physics education students' understanding of energy and its applications in University of Lagos
2. effect of gender on integrated science and physics education students' understanding of energy and its applications in University of Lagos
3. effect of mode of entry (UTME and DE) on integrated science and physics education students' understanding of energy and its applications in University of Lagos

Research Questions

1. What is the mean gain of integrated science students and physics education students in Adaptive personalized digital learning platform and those in the control group?
2. What are the mean scores of male students (integrated science students and physics education students) and female students (integrated science students and physics education students)?
2. What is the mean score of UTME (integrated science students and physics education student) and that of DE (integrated science students and physics education students)?

Research Hypotheses

1. There is no significant difference between the understanding of integrated science and physics education students taught using adaptive personalized digital learning and their counterparts taught using lecture method.
2. There is no significant difference between the understanding of male integrated science education students and physics education taught using adaptive personalized digital learning and their female counterparts taught using same method physics.
3. There is no significant difference between the understanding of UTME students taught using personalized digital learning and their direct entry counterparts taught using same method.

Methodology

This study adopted a quasi-experimental research design with a non-equivalent pretest -post-test control group research design. The design enabled the researcher to assess the impact of a

personalized digital learning intervention on students' understanding of the selected physics topics in Integrated Science from their 300 level courses- STI 324.

The target population comprised all third-year Integrated Science and physics education students of the University of Lagos. A purposive sampling technique was used to assigning the 26 students who came first to experimental group, while the remaining 23 students were assigned to control group from the Department of Science Education. The experimental group was treated using personalized digital learning, while the control group received instruction through traditional lecture method. The sample size of 49 intact class was engaged based on class sizes, and the researcher ensured that both groups were similar in academic background and demographic characteristics. Both groups covered the same physics topics over a 6-week period, after the development of the adaptive personalised digital learning platform and pre-test were developed for duration of two weeks. After the administration of the treatment, there was revision of four days before the administration of the post test, so from the development of adaptive personalised learning platform. Making a period of nine weeks for study. The content of the study includes concept and unit of energy, sources of energy, and forms of energy, gravitational potential and mechanical/electrical power, obtained from their university course scheme.

The main instrument used was a Physics understanding Achievement Test (PUAT) developed by the researcher. The test consisted of 40 multiple-choice questions aligned with the course content and validated by subject matter experts in Physics and Science Education. In addition to this, items used were validated (items by items), using parallel reliability coefficient, and a reliability scale of .743, which indicates a fair reliability.

Quantitative data were analysed using SPSS (Version 27), just as descriptive statistics (mean, standard deviation) were used to summarize test scores, and independent samples test was used to determine within-group differences between pre-test and post-test scores.

Results

Research Question 1: What is the mean gain of integrated science students and physics education student in Adaptive personalized digital learning platform and those in the control group?

Table 1.0: Paired Samples Statistics of both Groups

Paired Samples Statistics		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRETEST_ADAPTIVE PERSONALIZED LEARNING PLATFORM	1.27	26.00	1.59	0.31
	POST_TEST_ ADAPTIVE PERSONALIZED LEARNING PLATFORM	36.88	26.00	3.08	0.60
Pair 2	PRETEST_CONTROL	0.57	23.00	0.73	0.15
	POST_TEST_CONTROL	29.61	23.00	7.28	1.52

Mean difference of Adaptive personalized learning platform is 35.1

Mean difference of Control Group is 29.04

Research Question 2: What are the mean scores of male students (integrated science students and physics education student) and female students (integrated science students and physics education student)?

Table 2.0: Descriptive Statistics of Performance of students in Both Groups against their Gender

BOTH_TEACHING_METHODS								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Upper Bound	Min. Max.
MALE	16	32.06	7.16	1.79	28.25	35.88	21	39
FEMALE	33	34.15	6.21	1.08	31.95	36.35	19	40
Total	49	33.47	6.54	0.93	31.59	35.35	19	40

From Table 2.0 above shows significant difference in the performance of integrated science students compared to their physics education student counterparts. In contrast to the ideal, the integrated science students significantly outperformed (with a mean difference of 3.0833) their physics education counterparts, in the physics topics treated. This is an indication that irrespective of the area of specialization, personalized digital learning is capable of personalizing effective learning, provided the students concerned dedicate the required attention to the learning processes.

Research Question 3: What is the mean score of UTME (integrated science students and physics education student) and that of DE (integrated science students and physics education students)?

Table 3.0: Descriptive Statistics of Performance of students in Both Groups against their Mode of Entry

BOTH_TEACHING_METHODS								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Upper Bound	Min. Max.
UTME	37	32.27	6.95	1.14	29.95	34.59	19	39
DIRECT	12	37.17	2.95	0.85	35.29	39.04	31	40
Total	49	33.47	6.54	0.93	31.59	35.35	19	40

From Table 3.0 it shows that Direct entry students are 12 while UTME students are 37. The mean of Direct Entry is 37.17 which is greater than that of UTME which is 32.27

Hypothesis 1: There is no significant difference on the understanding of integrated science and physics education students taught using adaptive personalized digital learning and their counterparts taught using lecture method.

Table 4.0: One Sample Test Showing Difference between Personalized Digital and Lecture Learning Methods

One-Sample Test						
Test Value = 0						
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
Post-Test Adaptive Personalized	61.129	25	0.000	36.88462	Lower 35.6419	Upper 38.1273
Post-Test Lecture Method	19.493	22	0.000	29.60870	26.4585	32.7588

As seen on the above table 4.0, the p-value is less than 0.05 level of significance. This means that there is significant difference on the understanding of integrated science and physics education students taught using adaptive personalized digital learning and their counterparts taught using lecture method.

Hypothesis 2: There is no significant difference between the understanding of male integrated science education students and physics education taught using adaptive personalized digital learning and their female counterparts taught using same method physics

Table 5.0: Independent Samples Test on Influence of Gender on Personalized Learning

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Post-Test_Exp_Group	Equal variances assumed	9.883	0.00	1.25	24	0.23	1.61	1.29315	-1.06	4.28
	Equal variances not assumed			1.76	22.38	0.09	1.61	0.91821	-0.29	3.51

Descriptive Statistics of Performance of students in Both Groups against their Gender

BOTH_TEACHING_METHODS								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean			
					Lower Bound	Upper Bound	Minimum	Maximum
MALE	16	32.06	7.16	1.79	28.25	35.88	21	39
FEMALE	33	34.15	6.21	1.08	31.95	36.35	19	40
Total	49	33.47	6.54	0.93	31.59	35.35	19	40

Looking at Table 5.0 there is no significant difference between the understanding of male integrated science education students and physics education taught using adaptive personalized digital learning and their female counterparts taught using same method physics so Mean difference between male and female is 2.09 which is not significant at 0.05 level

Hypothesis 3: There is no significant difference between the understanding of UTME students taught using personalized digital learning and their direct entry counterparts taught using same method

Table 6.0: Independent Samples Test on UTME versus Direct Entry Students

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Post_Test_Exp_Group	Equal variances assumed	0.00	0.95	-0.41	24	0.688	-0.51	1.26	-3.12	2.09
	Equal variances not assumed			-0.40	18.52	0.693	-0.51	1.28	-3.19	2.16

Table 5.0: Statistics on UTME versus Direct Entry Students' Performance

Report			
POST_TEST_EXP_GROUP			
ENTRY_MODE_EXP	Mean	N	Std. Deviation
UTME	36.6875	16	3.07069
DIRECT ENTRY	37.2000	10	3.22490
Total	36.8846	26	3.07671

Looking at Table 6.0 there is no significant difference between the understandings of UTME students taught using personalized digital learning and their direct entry counterparts taught using same method so mean difference between UTME Mode of Entry and Direct Entry is 0.5125 which is not significant at 0.05 level.

Discussion

Results showed that students in the Adaptive personalized digital learning platform ($M = 1.27$, $SD = 36.88$) scored significantly higher than students in the Control method group ($M = 0.57$, $SD = 29.61$), just as group statistics indicated that Adaptive personalized digital learning is not affected this is because students under them are able to work independently with digital devices whereby able to visualize all the concept of energy, transformation, sources, various forms of energy whereas as there are working they are getting instant feedback instantly of classroom which makes the learning real and practical unlike the other group who learn the physics topics through abstract methods.

This improvement may be attributed to the interactive and engaging nature of the digital learning environment, which allows learners to visualize energy concepts, receive instant feedback, and progress at their own pace. These features align with earlier research (Pokhrel, 2024; Rana, 2020) highlighting how technology-supported learning can deepen understanding and motivation, particularly in abstract subjects like physics.

Furthermore, the hypothesis testing showed a statistically difference ($p < 0.05$) in understanding between the adaptive personalized digital methods and lecture methods, thereby confirming the positive impact of adaptive digital tools in physics instruction.

However, when it came to gender differences, although female students had a slightly higher mean score (34.15) than their male counterparts (32.06), the difference was not statistically significant. This is because both male and female were exposed to same adaptive personalized digital platforms which make them to understand physics topics in the same way which aligns with Karimi finding (2024) that gender does not inherently determine performance in physics, especially when learners are provided with equitable learning resources and personalized instruction.

The mode of entry is also not significant which shows that DE and utme students are exposed to the same group. There are able to work on their own to have higher engagement with physics topics and materials.

Overall, the results of this study reinforce the value of personalized digital learning in enhancing student-centered learning, improving academic performance, and reducing performance disparities across gender and entry mode. These outcomes advocate for the broader adoption of such platforms in science education across Nigerian universities and beyond.

Conclusion

The study has found that the adaptive personalized digital learning tools significantly enhanced the understanding of Integrated Science students and Physics education students in Energy and it related applications. Also, gender disparities in physics topics in integrated science are eliminated by the platform and finally there is no significant difference in the understanding of integrated science physics education students in physics topics

Recommendations

Based on the findings of this study, the following recommendations are hereby given:

1. The adaptive personalized learning platform is highly recommended for understanding of physics topics.
2. The Adaptive personalized learning platforms is highly recommended for closure of gender gap in physics topics and for closing difference in understanding of physics topics caused by mode of entry.
3. Institutions should adopt adaptive digital learning platforms that tailor physics content to students' unique learning needs and styles for proper understanding of physics concepts.
4. Curriculum developers should incorporate interactive simulations, personalized quizzes, and multimedia resources into the physics education framework.
5. Continuous professional development programs should be provided to train lecturers and teaching assistants in the effective use of digital learning technologies.
6. The University should work toward ensuring all students have access to the required digital devices, stable internet connections and stable electricity to fully benefit from personalized learning.
7. Building on the success in physics topics, personalized digital learning approaches should be extended to other areas within the Integrated Science curriculum.

Contribution to Knowledge

1. The study has revealed the efficacy of adaptive personalized digital learning platform over the lecture method of the understanding of physics topics.
2. The study has closed the gender gap in physics with the use of adaptive personalized digital learning platforms.
3. The study has closed the gap of differences in understanding of physics topics caused by mode of entry with the use of adaptive personalized digital learning platforms.

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HARNESSING THE POWER OF ICT USAGE IN STEAM TO IMPROVE THE QUALITY OF TEACHING AND LEARNING IN NIGERIA

Flourish Isaac-Oloniyo (Ph.D)

Wesley University Ondo

flourishingisaac@gmail.com

Abstract

Information and Communication Technology (ICT) integration into STEAM (Science, Technology, Engineering, Arts, and Mathematics) education is increasingly recognized as a transformative approach to enhancing educational quality and relevance in the face of rapid technological advancement and global challenges. This study examines the current state of ICT integration in Nigerian STEAM classrooms, focusing on its impact on teaching strategies, student engagement, and learning outcomes. Guided by constructivist learning theory and the Technological Pedagogical Content Knowledge (TPACK) framework, the study adopts a quantitative survey method to assess the frequency and nature of ICT use by educators. Findings reveal a partial and uneven adoption of ICT tools. While collaborative practices such as digital communication and online professional development are gaining traction, basic instructional tools like projectors and simulation software remain underutilized. Key challenges include inadequate infrastructure, insufficient teacher training, and curriculum gaps. Nevertheless, high levels of teacher participation in online training and openness to ICT use indicate a readiness for change. The study recommends targeted investments in ICT infrastructure, sustained teacher capacity building, and curriculum reforms to deepen integration. Addressing these systemic challenges will enable Nigeria to fully leverage ICT for inclusive, innovative, and future-ready STEAM education.

Keywords: Information, Communication, Technology, STEAM, Quality of Teaching

Introduction

In an era defined by rapid technological advancements and interconnected global challenges, the integration of Science, Technology, Engineering, Arts, and Mathematics (STEAM) education has emerged as a pivotal strategy for fostering innovation and addressing complex issues. STEAM education transcends traditional disciplinary boundaries, promoting interdisciplinary learning that equips students with the critical thinking, creativity, and problem-solving skills essential for navigating the complexities of the modern world. Globally, the significance of STEAM education is increasingly recognized as a catalyst for economic growth and societal development. For instance, initiatives like the Ghana Robotics Competition 2024 have demonstrated the potential of STEAM education in addressing pressing challenges such as climate change, water scarcity, and food security. Through hands-on projects and collaborative problem-solving, students are empowered to develop innovative solutions that have real-world applications (theb&ftonline, 2024; Eloise, 2024). The increasing complexity of global challenges such as climate change, technological disruption, and social inequality demands innovative, interdisciplinary approaches to education. Science, Technology, Engineering, Arts, and Mathematics (STEAM) education, enriched by the application of Information and Communication Technology (ICT), has become a transformative force in modern pedagogy. In Nigeria, where education systems face challenges ranging from teacher shortages to inadequate infrastructure, ICT-integrated STEAM holds promise for improving teaching quality and learning outcomes.

In Nigeria, the adoption of STEAM education holds promise for transforming the educational landscape. By integrating Information and Communication Technology (ICT) into the STEAM framework, there is an opportunity to enhance the quality of teaching and learning, making education more engaging and relevant to the needs of the 21st century. However, challenges such as inadequate infrastructure, limited access to digital resources, and the need for teacher training must be addressed to fully realise the potential of ICT in STEAM education. ICT integration in STEAM education is still inconsistent in Nigeria, despite the country's growing investments in digital infrastructure and educational reform. Systemic deficiencies still exist despite the dedication shown by many initiatives including UBEC's STEAM curriculum modules and the Federal Ministry of Education's ICT for Education strategy (Guardian, 2024; Vanguard, 2023). Research indicates that when used properly, ICT resources such as digital labs, educational software, and simulations improve student engagement and promote inclusive learning (UNESCO, 2023; Obielodan & Afolabi, 2022). However, these resources are frequently unavailable in Nigerian schools, particularly in rural regions.

In order to convey social norms and develop human capital, education is crucial. Digital technology adoption and integration in the classroom are widely supported. Growing hope that such a policy approach might confer a wide range of potential benefits to economies and society as a whole has made the digitisation of education a cornerstone of education policy around the world. Sadly, despite this hope, there are still digital disparities in education that affect the most vulnerable members of society, such as those who live in rural areas or are socioeconomically disadvantaged. For the purpose of evaluating progress and guiding policy and action, it is imperative that digital technologies in education be rigorously measured (Lynn et al., 2022).

Educational institutions are under increasing pressure to teach students the knowledge and skills they will need in the digital age through the use of information and communication technology (ICT). ICT is becoming more prevalent in both our everyday lives and educational system. Incorporating ICT into the teaching and learning environment gives teachers and students greater chances to work together more successfully in the globalised digital age. Whether used in the classroom, for administration, for online instruction, or for other purposes, ICT has the potential to become an increasingly important part of education (Lawrence, 2022).

The Hammou (2021) study looked into the most widely used ICT tools for teaching language skills and components in Moroccan high school EFL classes. The results of the study demonstrated that teaching speaking and listening skills involved high ICT usage, in contrast to teaching language components and reading and writing, which integrated medium and low ICT use, respectively. The results also indicated that instructors' preferred ICT tools include PCs, laptops, and projectors. According to this study, instructors' preference for ICT tools seems to have an impact on how frequently they utilise them. Finding the factors that might affect teachers' decisions to use ICT into teaching and learning was the aim of the Lawrence (2022) study. Furthermore, ICT's strategic significance in education in general and its enormous potential to revolutionise classroom instruction are the main reasons the study was selected. For engaging teaching and learning at the individual, group, and societal levels, it offers chances for more flexibility, engagement, and accessibility. Although there are many studies in the field, not much empirical study has been done to look at this phenomenon from the perspective of teachers. In-depth case studies that were conceptualised using the grounded theory technique were used in the study to create a model that will clarify and improve knowledge of the factors influencing teachers' usage of ICT in the classroom. The diffusion theory served as the theoretical foundation for the study.

The validity and usefulness of Technological Pedagogical Content Knowledge (TPACK) as a framework to gauge how well teachers can use technology in the classroom depend on the ability to compile findings from many empirical investigations, according to a study by Young et al. (2012). Confidence intervals (CIs) were used to synthesise the data obtained from the pre-service teacher knowledge of teaching with technology (TKTT) survey. The mean pre-service teacher TPACK point estimates were characterised by graphing CIs across studies conducted between 2009 and 2011. The findings include implications for academics and teacher educators as well as approximations of TPACK population parameters.

Statement of the Problem

While the global shift toward ICT-integrated STEAM education has yielded positive outcomes in many countries, the Nigerian context presents unique constraints. These include infrastructural deficits, lack of teacher ICT proficiency, and limited funding.

Consequently, many students are unable to benefit from transformative learning experiences that prepare them for future careers. There is a need to systematically evaluate how ICT is currently used within STEAM disciplines in Nigeria and to understand its impact on student learning and teacher effectiveness.

Specific Objectives

- To examine how the integration of Information and Communication Technology (ICT) within STEAM education enhances the quality of teaching and learning outcomes in Nigerian schools; and
- To investigate the extent to which ICT tools and practices are integrated into STEAM education in Nigeria, identify the challenges educators face in this integration, and assess the impact on student engagement, creativity, and academic performance.
-

Research Question

How does the integration of ICT in STEAM education influence the quality of teaching and learning in Nigeria, and what are the main barriers to its effective implementation?

Significance of the Study

This study is significant because it provides empirical insights into the role of ICT in enhancing STEAM education in Nigeria. It aims to inform policymakers, curriculum developers, and educators on best practices and scalable solutions for improving education quality through technology. The findings may also support government and donor-driven educational investments by identifying high-impact ICT interventions.

Theoretical Framework

This study's theoretical framework was based on constructivist learning theory and technological pedagogical content knowledge (TPACK): TPACK Framework (Mishra & Koehler, 2006): This paradigm emphasises the intricate relationship that exists between subject matter expertise, teaching techniques, and technology knowledge. It emphasises how important it is for educators to meaningfully use ICT technologies into the STEAM curriculum rather than merely using them. Constructivist Theory of Learning (Vygotsky, 1978; Piaget, 1973): places a strong emphasis on learner-centred settings where students can solve problems and gain knowledge. These active learning concepts are supported by ICT in STEAM, such as coding platforms or virtual labs.

Methodology

A survey research methodology was used for this study. Data was gathered using a Google Form that contained eight elements under "the actual use of ICT in Teaching." The dependability coefficient of the instrument is 0.942.

Presentation and Interpretation of Data Analysis

Table 1 shows the frequency of ICT usage among teachers in STEAM education across various teaching practices.

Table 1: The Frequency of ICT usage among teachers in STEAM education.

Items	Never	Rare	Sometimes	Often	Always
1. Using a projector to present lesson content	25.0%	25.0%	12.5%	25.0%	12.5%
2. Having students use computers for hands-on practice	12.5%	12.5%	12.5%	37.5%	25.0%
3. Accessing online resources during lessons	0.0%	50.0%	12.5%	25.0%	12.5%
4. Assigning ICT-based homework or projects	25.0%	25.0%	12.5%	25.0%	12.5%
5. Using simulation software or subject-specific apps	0.0%	37.5%	37.5%	12.5%	12.5%
6. Communicating with students using digital platforms	12.5%	12.5%	37.5%	0.0%	37.5%
7. Collaborating with other teachers using ICT tools	0.0%	25.0%	25.0%	25.0%	25.0%
8. Participating in online training or ICT webinars	0.0%	25.0%	25.0%	25.0%	25.0%

The interpretation of the results of the analysis in Table 1 revealed, High Use: Items 2 (student hands-on computer use), 6 (digital communication with students), 7 (teacher collaboration), and 8 (online training) show relatively high regular use (50% or more often/always). Notably, 37.5% of respondents often allow students to use computers, and another 25% always do. Moderate Use: Many teachers utilise items 3 (using online resources) and 5 (using simulations/apps) "rarely" or "sometimes," indicating that they are modestly used. Low Use: 50% of respondents said they either never or very seldom use projectors or assign digital projects, indicating inconsistent application of items 1 (projector use) and 4 (assigning ICT-based assignments).

Discussion

The findings reflect a mixed level of ICT integration in Nigerian STEAM classrooms. While there are encouraging trends in collaborative and communicative ICT usage, such as professional growth (Item 8) and digital communication with pupils (Item 6), basic instructional tools like projectors and subject-specific simulations remain underutilized. This suggests a disconnect between potential and practice: teachers may have some access to ICT tools but lack consistent infrastructure, training, or curricular support to fully integrate them into teaching.

Moreover, the relatively low frequency of ICT-based homework and simulation use indicates missed opportunities for extending learning beyond the classroom and enhancing conceptual understanding through visual/interactive tools. This is consistent with findings by Obielodan &

Afolabi (2022), who noted that many Nigerian teachers express willingness but are constrained by lack of training and resources. The high levels of participation in peer cooperation and online training (Items 7 and 8) are encouraging because they indicate a developing professional culture that is open to learning and adapting, which provides a solid basis for capacity building and policy intervention.

More clearly, the analysis of the actual use of Information and Communication Technology (ICT) in teaching within Nigerian classrooms reveals a nuanced landscape characterised by varying degrees of integration across different teaching practices. The findings indicate that while there is notable engagement with certain ICT tools and methods, several barriers impede the broader and more effective utilisation of technology in education. The study revealed that, there was high use of ICT in teaching practices. The data indicates that certain ICT applications are more frequently utilized by educators. Notably, 37.5% of respondents often allow students to use computers, and another 25% always do so. This aligns with findings from Glitters Future Leaders Academy (2024), which highlighted that digital tools facilitate real-time collaboration among students and teachers, enabling group projects and discussions even when students are not physically together. Additionally, 37.5% of teachers reported using digital platforms to communicate with students, underscoring the growing trend of leveraging technology to enhance communication and collaboration in educational settings. The participation of 50% of teachers in online training or ICT webinars suggests a proactive approach towards professional development. This is in line with the Universal Basic Education Commission's (UBEC) findings, which have highlighted the value of incorporating the arts into science and technology instruction to encourage students' creativity and critical thinking (Guardian Nigeria, 2024).

Furthermore, moderately use of ICT tools was revealed. While certain ICT tools are employed regularly, others see more sporadic use. Accessing online resources during lessons was reported by 50% of teachers as occurring rarely, indicating that while the internet is a valuable resource, its integration into daily teaching practices is inconsistent. Similarly, the use of simulation software or subject-specific applications was reported as moderate, with 37.5% of teachers using them rarely and another 37.5% using them sometimes. This suggests that while there is recognition of the benefits of such tools, their adoption is hindered by factors such as lack of training and infrastructure (Nwosu & Emecheta, 2023).

It was revealed that, there are low use of ICT in certain teaching practices. Certain ICT applications remain underutilized in Nigerian classrooms. The use of projectors to present lesson content was reported as infrequent, with 50% of respondents either never or rarely using them. This is corroborated by findings from George (2024), which indicated that while ICT tools were available, they were not adequately utilized due to factors such as inadequate funding and lack of supervision. Similarly, assigning ICT-based homework or projects was reported as low, with 50% of teachers either never or rarely assigning such tasks. This highlights a gap in extending the use of ICT beyond the classroom setting, potentially limiting students' opportunities to engage with technology in diverse contexts.

Barriers to effective ICT integration are not disputable. The underutilisation of certain ICT tools can be attributed to several challenges. Infrastructure deficits, including unreliable electricity supply and limited access to digital devices, pose significant obstacles to the effective integration of technology in education (Kings Care School, 2024). Additionally, the lack of comprehensive training programs for teachers hampers their ability to effectively incorporate ICT into their teaching practices (Nwosu & Emecheta, 2023). These challenges underscore the need for targeted interventions to address infrastructural deficiencies and enhance teachers' digital literacy.

While there is a growing recognition of the importance of ICT in enhancing teaching and learning in Nigeria, the actual use of technology in classrooms varies across different practices. To maximize the potential of ICT in education, it is imperative to address the existing barriers through strategic investments in infrastructure, comprehensive teacher training programs, and the development of policies that support the integration of technology into the educational system. By doing so, Nigeria can harness the full potential of ICT to improve the quality of education and better prepare students for the demands of the 21st century.

Conclusion

The integration of Information and Communication Technology (ICT) in STEAM education within Nigerian schools reveals a pattern of partial and uneven adoption. While educators demonstrate high engagement in collaborative and communicative ICT procedures like professional growth, digital communication, and student-computer interaction, basic instructional technologies like projectors and subject-specific applications remain significantly underused. This dichotomy reflects a deeper systemic issue: while there is growing awareness and willingness among teachers to leverage ICT, infrastructural deficits, inadequate training, and weak curricular integration constrain its full and effective implementation.

The findings highlight a critical need to address these gaps, especially in extending ICT use beyond classroom instruction into independent student activities and interactive learning. The data suggests that although Nigeria is making strides in digital education awareness, the country must invest more deliberately in ICT capacity-building initiatives for both teachers and schools. Encouragingly, teacher engagement in online learning and collaboration presents a strong foundation upon which more holistic ICT integration strategies can be built.

Harnessing the power of ICT in STEAM education is not merely an option but a necessity if Nigeria is to equip its students with the skills required to thrive in a technology-driven global economy. Therefore, a coordinated effort involving policymakers, educators, communities, and development partners is essential to overcome current limitations and unlock the full educational potential of ICT in STEAM.

The results emphasise the need for targeted investment in:

- ICT infrastructure in classrooms, especially projectors and content-specific apps
- Ongoing digital literacy training for teachers
- Curricular reforms that embed ICT-based assignments and learning experiences

Such measures could significantly boost the depth and quality of STEAM education, empowering teachers and students to harness technology as a tool for transformative learning.

Recommendations

There is tremendous potential for teachers and students to harness the power of ICT to improve the quality of teaching and learning in the classroom, through the following recommendations. By implementing these recommendations, Nigeria can create an enabling environment for ICT-enhanced STEAM education, thereby nurturing a generation of learners equipped with the skills to solve local and global challenges innovatively and competently.

1. Invest in ICT Infrastructure and Connectivity: Expand access to computers, projectors, internet, and reliable power (including solar solutions) in all schools, prioritizing rural and underserved areas.
2. Build Teacher Capacity through Continuous Training: Institutionalise regular professional development to enhance teachers' digital skills, focusing on integrating ICT tools and applications into STEAM teaching.

3. Integrate ICT into Curriculum and Learning Activities: Revise the national curriculum to include ICT-based modules and promote digital projects and homework to strengthen students' technological literacy.
4. Monitor Progress and Foster Collaboration: Establish strong monitoring systems and create collaborative platforms where educators can share best practices, mentor peers, and drive ICT innovation in schools.

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INVESTIGATING THE PERCEPTIONS AND ACCEPTANCE OF ARTIFICIAL INTELLIGENCE INTEGRATION IN GENERAL STUDIES AMONG MEDICAL-RELATED STUDENTS AT UNIVERSITY OF NIGERIA ENUGU CAMPUS (UNEC)

¹Oguejiofor, Chidumebi Ngozi, (Ph.D), ²Ani Anthonia Nwabugo (PhD),
³Obiekwe Kingsley Kenekwuwu (PhD), ⁴Thompson, Chidinma Chinenye (Ph.D),
⁵Ogbo, Rosita Nwaribeaku & ⁶Eziamaka, Chika Nnoye
^{1,2,3,4}Educational Management and Policy Department,
Nnamdi Azikiwe University Awka
cn.oguejiofor@unizik.edu.ng

Abstract

This study investigated the perceptions and acceptance of artificial intelligence (AI) integration in General Studies among medical-related students at the University of Nigeria Enugu Campus (UNEC). A quantitative research design utilizing a questionnaire was employed to assess students' awareness, understanding, perceived benefits and challenges, ethical concerns, and readiness towards AI. The findings revealed a high level of awareness regarding AI's relevance in medicine (mean=3.82), but a gap in technical understanding, particularly distinguishing AI, machine learning, and deep learning. Students held positive perceptions of AI's potential to enhance General Studies instruction (mean=3.75), recognizing benefits like personalized learning while expressing caution about the role of human instructors and ethical implications. Perceived benefits of AI integration (mean=3.74) included improved learning efficiency, though concerns about reduced interaction and data privacy were noted. Ethical considerations were significant (mean=4.07), with strong agreement on the need for data protection and transparency, alongside moderate concerns about bias. Overall acceptance of AI integration was positive (mean=3.79), but perceived readiness was tempered by self-reported limitations in digital skills and a perceived lack of institutional support. The study highlights the need for enhanced AI education within the medical curriculum, comprehensive training programs, and a focus on addressing ethical concerns and ensuring equitable access to facilitate successful and responsible AI integration in medical education.

Keywords: Artificial Intelligence, Medical Education, General Studies, Student Perceptions, Technology Acceptance, Ethical Concerns, University Education.

Introduction

The integration of artificial intelligence (AI) into higher education is reshaping the landscape of teaching and learning globally. In medical education, the potential of AI to support personalized learning, automate administrative tasks, and enhance student engagement has prompted institutions to re-evaluate their educational approaches. General Studies (GS) courses, which form a core part of Nigerian university curricula, aim to cultivate broad intellectual skills and critical thinking. In the context of Nigerian higher education, the integration of AI presents both opportunities and challenges, particularly within interdisciplinary courses such as General Studies (GS). For medical-related students at the University of Nigeria, Enugu Campus (UNEC), understanding and adapting to AI technologies is crucial, not only for their academic success but also for their future roles in a rapidly evolving healthcare sector. This study aims to investigate the perceptions, attitudes, and readiness of these students towards the integration of AI in GS

courses, focusing on their awareness, perceived benefits and challenges, ethical concerns, and overall acceptance of AI-enhanced education.

The advent of AI in education has revolutionized traditional teaching and learning processes, introducing tools that facilitate adaptive learning, intelligent tutoring systems, and automated assessments. In Nigeria, the adoption of AI in educational settings is still emerging, with varying degrees of awareness and implementation across institutions. Studies indicate that while there is a growing recognition of AI's potential, many students, including those in medical fields, possess limited knowledge and exposure to AI applications in their academic pursuits (Obiekwe et al. 2024). Artificial intelligence technologies—ranging from intelligent tutoring systems and adaptive learning platforms to automated feedback and virtual assistants—have become integral to modern education systems.

General Studies courses, designed to provide a broad-based education and critical thinking skills, are integral to the Nigerian university curriculum. Integrating AI into these courses could enhance learning outcomes by providing personalized content, fostering interactive learning environments, and accommodating diverse learning styles. Despite increasing awareness of AI's capabilities in clinical applications, limited research exists on its pedagogical relevance from the perspective of medical students in Nigeria. General Studies, often perceived as non-core by medical-related students, may benefit from innovative AI applications that enhance engagement and contextual relevance. However, students' perceptions, understanding, and ethical concerns remain underexplored. There is a pressing need to examine how medical-related students at UNEC perceive AI in the context of teaching and learning, especially within non-specialist, interdisciplinary courses. This gap in knowledge represents a critical problem: while AI holds potential to improve educational experiences, its effective implementation hinges on the readiness and acceptance of its primary stakeholders—students. Without an informed understanding of their attitudes and concerns, AI integration may face resistance, misalignment with learning goals, or ethical conflicts. Therefore, this study addresses an urgent need to explore the multifaceted perceptions of AI among UNEC's medical-related student population.

Artificial Intelligence (AI) is increasingly becoming a core component of modern healthcare, revolutionizing diagnostics, treatment planning, patient monitoring, and administrative efficiency. As AI technologies become more embedded in clinical practice, it is crucial that medical students—future healthcare professionals—possess a foundational awareness and understanding of these systems. Awareness, in this context, refers to the extent to which students are informed about AI's role and presence in healthcare, while understanding relates to their grasp of how AI functions, its capabilities, and its limitations. Together, these aspects shape students' preparedness to interact with AI-enhanced tools and systems. Recent research indicates that many medical students are aware of AI's presence in medicine but often lack a deeper understanding of its operational principles. For example, a survey conducted by Sit et al. found that although 88% of medical students had heard of AI, only 9% felt confident in their understanding of how AI works.

This suggests a gap between surface-level awareness and practical comprehension. Moreover, studies emphasize the need to integrate AI literacy into medical curricula. A systematic review by Pinto dos Santos et al. revealed that while students were interested in learning about AI, they often lacked formal education in the subject, which could hinder their ability to evaluate AI tools critically or use them effectively (Pinto dos Santos et al. 14). Understanding AI is not solely technical; it involves critical thinking about algorithmic decision-making, data privacy, and ethical implications. As Davenport and Kalakota argue, the rise of AI in healthcare demands that physicians understand not only how to use AI tools but also how to question their outputs and

ensure they are used responsibly (Davenport and Kalakota, 2019). Therefore, fostering both awareness and understanding is vital. Medical education should aim to equip students with conceptual knowledge, practical competencies, and ethical sensitivity regarding AI. This prepares future clinicians not only to work with AI systems but to shape their development and application in patient-centered ways.

As artificial intelligence (AI) becomes more integrated into higher education, its relevance is expanding beyond clinical disciplines into broader areas such as General Studies. For medical students, General Studies courses often serve to build critical thinking, communication, ethics, and interdisciplinary awareness—skills that are increasingly important in the age of AI. Understanding their attitudes toward AI in this context is essential, as it reflects both openness to innovation and readiness to engage with evolving educational technologies. Generally, students' attitudes toward AI in education are shaped by their perceptions of usefulness, ease of use, trust in technology, and perceived impact on learning. A study by Chan and Zary found that while health professions students recognize the potential of AI to personalize learning and provide adaptive feedback, they also express concern about reduced human interaction and overdependence on technology (Chan and Zary, 1, 2019). In the context of General Studies, AI can offer dynamic learning tools such as intelligent tutoring systems, automated feedback, and AI-driven writing assistants. Medical students may view these tools as enhancing their ability to engage with non-clinical content more efficiently. However, studies suggest that attitudes vary depending on students' prior exposure to AI and the perceived relevance of General Studies to their medical careers. For instance, research by Eysenbach and colleagues shows that while students value AI's efficiency, they also worry about the erosion of critical discussion and ethical reflection—core components of General Studies education (Eysenbach et al. 2020).

Another key influence on attitudes is the perceived role of educators. Students tend to have more positive views of AI when it is used to support, rather than replace, human instruction. In this light, the role of AI in General Studies should be framed as augmentative—enhancing learning without undermining the value of human mentorship, dialogue, and ethical inquiry. In summary, medical students generally hold a cautiously optimistic attitude toward the use of AI in General Studies teaching. They acknowledge the potential for increased engagement and personalization, but they also express concerns about depersonalization and loss of critical, reflective educational spaces. Educators must consider these attitudes when designing AI-enhanced General Studies courses, ensuring that technology complements rather than replaces the human elements of education.

As artificial intelligence (AI) becomes increasingly integrated into healthcare and medical education, understanding how medical students perceive its benefits and challenges is crucial. These perceptions influence their acceptance, readiness, and engagement with AI-based technologies, both in their learning environments and future clinical practice.

Perceived Benefits.

One of the most commonly cited benefits of AI integration is enhanced diagnostic support. AI can assist in analysing large volumes of clinical data, offering faster and sometimes more accurate diagnostic suggestions. Medical students recognize this potential, often viewing AI as a tool that can reduce cognitive workload, improve decision-making, and enhance patient care outcomes (Jha and Topol 131, 2016). AI also offers personalized learning experiences in education. Intelligent tutoring systems and adaptive learning platforms can provide individualized feedback and tailor content to suit students' learning paces and styles. According to Chan and Zary, such technologies may help learners grasp complex topics more efficiently, particularly in subjects like radiology

and pathology where pattern recognition is key (Chan and Zary 3, 2019). Additionally, medical students perceive that AI can optimize administrative and routine tasks, allowing them to focus more on clinical reasoning and patient interaction. Automation of documentation, scheduling, and even grading in educational settings can improve efficiency and reduce burnout (Liaw et al. 98, 2022).

Perceived Challenges

Despite these advantages, medical students also express significant concerns. A prominent challenge is the risk of over-reliance on AI. There is apprehension that students might defer critical thinking in favor of algorithmic outputs, potentially undermining the development of clinical judgment (Pinto dos Santos et al. 1642, 2019). Lack of training and understanding is another key issue. Many students feel ill-equipped to evaluate or critically interpret AI-driven recommendations. Without proper education, this technological gap could lead to misuse or overconfidence in AI tools (Park et al. 1573, 2019). Moreover, students are wary of ethical and legal challenges, such as patient privacy, data security, and accountability in the case of AI errors. These concerns are compounded by uncertainties about AI's regulatory framework and its impact on professional roles and responsibilities (Mesko et al. 2, 2017). In sum, medical students generally perceive AI as a promising and transformative force, but one that must be integrated carefully and ethically. Addressing their concerns through curriculum reform, ethical education, and practical exposure to AI tools can enhance both their competence and confidence in working alongside AI systems.

The integration of artificial intelligence (AI) into medical education has introduced a spectrum of ethical concerns among medical students. While AI offers promising advancements in teaching and learning, students are increasingly apprehensive about its implications on privacy, bias, clinical judgment, and the humanistic aspects of medicine. (BioMed Central, 2023)

- i. *Data Privacy and Informed Consent:* Medical students express significant concerns regarding the privacy and security of patient data utilized in AI systems. The potential for unauthorized access, misuse, or breaches of sensitive information necessitates stringent data protection measures. Moreover, the use of patient data in AI training underscores the importance of obtaining informed consent, ensuring that individuals are aware of and agree to how their data is used (D'Souza, 2024).
- ii. *Algorithmic Bias and Equity:* AI systems trained on biased datasets can perpetuate existing disparities in healthcare, leading to unequal educational outcomes and reinforcing systemic inequalities. Medical students are concerned that such biases in AI tools may affect their learning and future clinical decisions, emphasizing the need for diverse and representative datasets to train AI algorithms (SpringerLink, 2023).
- iii. *Impact on Clinical Judgment and Critical Thinking:* There is apprehension that over-reliance on AI could diminish the development of essential clinical skills among medical students. The opacity of AI decision-making processes may hinder students' ability to critically assess and understand diagnostic recommendations, potentially compromising their clinical reasoning and decision-making capabilities (Yilmaz, 2021; Brieflands, 2024).
- iv. *Humanistic Aspects and Patient-Physician Relationship:* A significant number of students believe that AI could reduce the humanistic aspect of medicine, negatively affecting the patient-physician relationship. Concerns include the potential erosion of empathy, communication skills, and trust, which are fundamental to patient care (Hadithy, 2024)
- v. *Educational Equity and Access:* The integration of AI in medical education raises concerns about equitable access to technology. Students from under-resourced institutions or regions may lack the necessary infrastructure, such as reliable internet and advanced hardware, to effectively engage with AI tools, potentially widening the educational gap (IJCap, 2024)

- vi. *Transparency and Accountability:* The "black-box" nature of many AI systems poses challenges in understanding how decisions are made, leading to difficulties in assigning accountability for errors. Students advocate for transparent AI systems where the decision-making processes are understandable, ensuring that responsibility can be appropriately attributed.
- vii. *Curriculum Integration and Ethical Training:* There is a recognized need for the inclusion of AI and ethics education within the medical curriculum. Students highlight the importance of being equipped with the knowledge to navigate AI technologies responsibly, emphasizing the necessity for training that addresses both the technical and ethical dimensions of AI in medicine (Chan, and Nabil, 2019).

While AI has the potential to revolutionize medical education, it is imperative to address the ethical concerns raised by medical students. Ensuring data privacy, mitigating algorithmic bias, preserving the humanistic elements of medicine, and providing equitable access are crucial steps. Furthermore, integrating comprehensive AI and ethics training into the medical curriculum will prepare future physicians to harness AI's benefits responsibly and ethically.

The integration of artificial intelligence (AI) into medical education has garnered significant attention, prompting investigations into medical students' acceptance and readiness for such technological advancements. Recent studies provide insights into students' perceptions, highlighting both enthusiasm and areas requiring development.

- d) *Awareness and Perceived Importance of AI:* Medical students globally recognize the growing significance of AI in healthcare. A study involving students from 48 countries revealed a unanimous agreement on the necessity of incorporating AI education into medical curricula, despite limited exposure to formal AI training. Similarly, in Nigeria, while 99.4% of students had heard of AI, only 3.2% were very familiar with its real-world applications (Ejaz, 2022).
- e) *Attitudes Toward AI Integration:* The general attitude among medical students toward AI is favourable. In a study with 702 participants, 80.3% viewed AI as a credible and effective learning tool, noting its efficiency in optimizing study time and providing up-to-date medical information. In Saudi Arabia, 83.3% of students acknowledged AI's crucial role in healthcare, with 74.2% believing that AI education would benefit their professional development (SpringerLink, 2025; Alsharif, 2025).
- f) *Readiness and Competency Levels:* Despite positive attitudes, readiness to effectively utilize AI remains moderate. In Saudi Arabia, only 26% of students reported understanding fundamental AI computational principles. A study assessing the Medical Artificial Intelligence Readiness Scale for Medical Students (MAIRS-MS) indicated that while students could harness AI-based information, many lacked the ability to analyse AI-generated data or organize AI-compatible workflows (D'Souza, 2024).
- g) *Curriculum Integration and Educational Needs:* There is a strong consensus on the need to integrate AI education into medical curricula. In a study, 74.8% of participants advocated for structured AI training during medical education, emphasizing topics like AI applications, ethical problem-solving, and AI-assisted risk analysis. Students also expressed interest in learning about clinical applications, algorithm development, and coding (SpringerLink, 2023, Ejaz, 2022)
- h) *Ethical Considerations and Concerns:* While students are open to AI integration, concerns persist regarding ethical implications. In Nigeria, 70.9% feared the potential loss of human touch in patient care due to AI. Additionally, students expressed apprehensions about data privacy and job displacement (Obiekwe, 2024).

Medical students exhibit a positive attitude toward AI integration in their academic journey, recognizing its potential to enhance learning and future clinical practice. However, to transition from acceptance to readiness, there is a pressing need for comprehensive AI education within medical curricula, addressing both technical competencies and ethical considerations.

Problem Statement

Despite the potential benefits of AI in enhancing educational experiences, there is a noticeable gap in understanding how medical-related students at UNEC perceive and accept AI integration in their GS courses. Limited awareness, apprehensions about ethical implications, and varying levels of technological readiness may hinder the effective adoption of AI in these courses. Without empirical data on students' attitudes and concerns, efforts to implement AI-driven educational tools may face resistance or fail to address the specific needs of the student population. This study seeks to fill this gap by systematically examining the awareness, attitudes, perceived benefits and challenges, ethical considerations, and readiness of medical-related students towards AI integration in their academic journey.

Purpose of the Study

The purpose of the study was to ascertain UNEC Medical Students' Perception and Awareness of AI. Specifically, the study was undertaken to:

1. assess the level of medical-related students' awareness and understanding of AI,
2. examine medical-related students' attitudes toward AI in General Studies teaching.,
3. identify medical-related students' perceived benefits and challenges of AI-enhanced education.
4. explore medical-related students' ethical concerns regarding AI use in teaching and learning, and
5. evaluate the level of medical-related students' acceptance and readiness for AI integration in their academic journey.

Research Questions

The following five research questions guided the study:

5. What is the level of medical-related students' awareness and understanding of AI?
6. How do medical-related students perceive the use of AI in General Studies instruction?
7. What benefits and challenges do medical-related students associate with AI integration?
8. What ethical issues concern medical-related students about the use of AI in their learning?
9. What is the level of medical-related students' acceptance and readiness for AI integration in their academic journey?

Hypotheses

The following null hypotheses tested at a 0.05 level of significance guided the study:

- HO₁:** Greater AI awareness is positively correlated with more favorable perceptions of AI in education.
- HO₂:** Perception and acceptance of AI vary significantly by department (Medicine, Dentistry, Nursing).
- HO₃:** Ethical concerns negatively impact students' acceptance of AI in teaching

Theoretical and Practical Significance

Theoretical Significance:

This study contributes to the academic discourse on technology acceptance in education by applying established models such as the Technology Acceptance Model (TAM) (Davis1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, 2003). By

focusing on medical-related students in a Nigerian university context, the research offers insights into how cultural, educational, and technological factors influence students' acceptance and readiness for AI integration. The findings can inform theoretical frameworks that address the unique challenges and opportunities of implementing AI in interdisciplinary courses within developing countries.

Practical Significance:

Practically, the study's outcomes can guide policymakers, educators, and curriculum developers at UNEC and similar institutions in designing and implementing AI-enhanced GS courses that align with students' needs and expectations. By identifying the levels of awareness, attitudes, and readiness among medical-related students, stakeholders can develop targeted interventions, such as curriculum design, awareness programs, infrastructure development, workshops, training programs, and support systems, to facilitate the effective adoption of AI technologies. Additionally, understanding student acceptance will enable more strategic deployment of AI in General Studies, potentially improving learning outcomes, student satisfaction, and digital literacy among future healthcare professionals. Moreover, understanding students' ethical concerns can help in establishing guidelines and policies that ensure responsible and equitable use of AI in educational settings

METHODS

Research Design

This study adopts a descriptive survey design, which is well-suited for exploring and analysing the perceptions, awareness, and acceptance of AI among medical-related students. A descriptive survey design is appropriate because it allows for the collection of data on students' attitudes, perceptions, and readiness without manipulating the study variables (Nworgu, 2015). The design enables the study to assess the existing state of knowledge, attitudes, and readiness regarding AI integration in General Studies courses at UNEC.

Area of the Study

The study was conducted at the University of Nigeria, Enugu Campus (UNEC), a premier public university located in Enugu, Nigeria. UNEC is one of the key institutions in the country and has a diverse student body, including a significant number of medical-related students enrolled in various disciplines such as Medicine, Dentistry, Nursing, Pharmacy, and Public Health. This setting provides an appropriate environment to explore how medical-related students, who will later be professionals in the healthcare sector, perceive and accept the use of AI in their academic journey.

Population for the Study

The population of this study consists of 200-level and 300-level students enrolled in the Departments of Medicine, Dentistry, and Nursing at the University of Nigeria, Enugu Campus (UNEC). These students are at an intermediate stage in their academic journey, which ensures that they have enough exposure to the curriculum and academic requirements to form informed opinions about the potential integration of Artificial Intelligence (AI) in their General Studies courses. The estimated total population of 200-level and 300-level students across these three departments is approximately 500 students

Sample Size and Techniques

In order to ensure that the sample is representative of the population, proportionate sampling was used. This sampling technique is particularly useful when there are differences in the size of groups within the population, as it allows for the selection of participants in proportion to their

actual representation in the overall population. Since the Departments of Medicine and Nursing have larger student populations compared to the Dentistry Department, proportionate sampling allocated more students from the larger departments. Based on an estimated total population of 500 students in the 200-level and 300-level groups across the three departments, and using Krejcie and Morgan's formula for sample size determination, the total sample size for the study is 220 students. The allocation of the sample size was done in proportion to the number of students in each department as follows: 152, 108, and 80 for the departments of Medicine, Nursing, and Dentistry, respectively

Instrument for the Study

The primary instrument for data collection was a structured questionnaire titled “**Medical Students' Perception and Awareness of AI Questionnaire (MSPAAIQ).**” The questionnaire was divided into several sections to address the specific objectives of the study: Section A: Demographic Information (Department). Section B: Awareness and understanding of AI. Section C: Students' attitudes toward AI in General Studies teaching. Section D: Perceived benefits and challenges of AI-enhanced education. Section E: Ethical concerns regarding AI use in teaching and learning. Section F: Students' acceptance and readiness for AI integration in their academic journey. Each section consisted of closed-ended ten item questions, designed to capture quantitative data, and Likert-type scale items to measure students' attitudes and perceptions.

Validation of the Instrument

The validity of the instrument was ensured through a process of content validation. A panel of experts in the fields of educational technology, medical education, and psychometrics reviewed the instrument to determine whether the items adequately address the research objectives and whether they are clear, relevant, and culturally appropriate. The feedback from the experts were used to refine and revise the questionnaire before it was administered to the sample.

Reliability of the Instrument

To ensure the reliability of the instrument, a pilot test was conducted with a small group of medical-related students at Coal City University, Enugu who are not part of the main study sample. This pilot test helped assess the clarity, consistency, and internal consistency of the instrument. The Cronbach's Alpha coefficient was used to determine the reliability of the instrument. A coefficient of 0.81 was obtained, indicating good internal consistency.

Method of Data Collection

Data was collected using the questionnaire. The researcher, along with trained research assistants, will administer the physical copies of the questionnaires during scheduled class periods. The process will be explained to the students, emphasizing the confidentiality of their responses. The estimated time for completing the questionnaire is 20 to 30 minutes.

Method of Data Analysis

The data collected from the questionnaire was analyzed using both descriptive and inferential statistics. Descriptive statistics (frequencies, percentages, mean scores, and standard deviations) was used to summarize and describe the data, particularly in assessing students' awareness, attitudes, perceived benefits and challenges, ethical concerns, and overall readiness for AI integration. Inferential statistics (such as chi-square tests, t-tests, or ANOVA) was used to test for significant differences in responses based on awareness and perceptions of AI in education, Perception and acceptance of AI by department, and Ethical concerns and students' acceptance of AI in teaching

Decision Rules

For Descriptive Analysis: The findings will be presented in terms of percentages and mean scores. Mean scores above 3.0 on a 5-point Likert scale was interpreted as "positive" or "agree," while scores below 3.0 was interpreted as "negative" or "disagree." For Inferential Analysis: A significance level of $p < 0.05$ was used. If the calculated p-value is less than 0.05, the null hypothesis was rejected, indicating a statistically significant difference or relationship between the variables.

Results

The results are presented in tables according to research questions

Research Question 1: What is the level of medical-related students' awareness and understanding of AI?

Table 1: Overall Summary of Responses to Research Question 1

RQ1	MEAN	SD	DECISION
Students' awareness and understanding of AI	3.82	1.00 (approx.)	Agree

Strong Awareness (Items 1, 2, 4, 8, 9): Over 65% of students agreed or strongly agreed that they are aware of AI's use, importance, and ethical implications. Moderate Knowledge (Items 3, 5, 6): Students can give examples and understand some principles, but deeper concepts remain unclear. Low Technical Familiarity (Item 7): Only 48.5% agreed or strongly agreed they can differentiate between AI, ML, and DL. Gap in Formal Education (Item 10): Over 28% disagreed or strongly disagreed they have received enough education on AI, with only 57.3% agreeing or strongly agreeing. This reflects a pattern of high awareness but uneven understanding, emphasizing the need to integrate AI concepts systematically into the medical curriculum.

Table 2: Overall Summary of Responses to Research Question 2

RQ2	MEAN	SD	DECISION
AI can positively impact General Studies instruction	3.75	1.05	Agree

High Awareness & Positive Attitudes: Students largely agree that AI can improve the relevance, personalization, and interdisciplinary application of General Studies. Items 11 to 17 have mean scores above 3.5, showing positive perceptions. Caution About Human Instructors: A slightly neutral to disagreeing trend (mean = 3.22) on item 18 suggests that students don't strongly believe AI will replace human instructors but are aware of the risk. Ethical Awareness: Item 19 shows a strong agreement (mean = 3.92), indicating that students are concerned about fairness and ethics in AI adoption. Need for Support: A very strong agreement on item 20 (mean = 4.07) highlights that students believe more training and institutional support are crucial for successful AI integration.

Table 3: Overall Summary of Responses to Research Question 3

RQ3	MEAN	SD	DECISION
The perceived benefits and challenges associated with AI integration	3.74	1.04	Agree

Perceived Benefits of AI: Most students agree that AI improves learning efficiency, understanding of complex topics, and supports self-paced study (Items 21–23). AI is also seen as beneficial for assessment consistency and simulated clinical training, reflecting its practical utility (Items 24–25). These items have high means (>3.75) and relatively low standard deviations, suggesting strong consensus and positive perception.

Perceived Challenges: Concerns about reduced student-teacher interaction, over-reliance impacting critical thinking, and data privacy (Items 26–28) have moderate agreement (mean ~ 3.1 – 3.3), indicating a recognition of trade-offs. Access to AI tools and training (Items 29–30) is a notable challenge; high agreement (mean >3.85) reflects digital inequality and skill gaps as major barriers.

Overall Sentiment: Every item scored above the 3.0 threshold, leading to an "Accept" decision across the board. Students exhibit an overall positive perception and awareness of AI's role in education, tempered by cautious awareness of its limitations and risks.

Table 4: Overall Summary of Responses to Research Question 4

RQ4	MEAN	SD	DECISION
Ethical Concerns About AI in Teaching and Learning	4.07	0.92	Agree

Strong Ethical Awareness: Students highly agree on the need for confidentiality, data protection, and transparency (Items 31–33, 36–38). Items 32 and 33 scored the highest means (4.31), suggesting a robust demand for privacy rights and informed consent in AI use.

Bias and Fairness Concerns: There is significant concern about algorithmic bias and fairness in assessments (Items 34–35), with moderate standard deviations (~ 1.12), indicating diverse perspectives.

Human Oversight and Autonomy: Items 39 and 40 highlight a clear preference for human-centered education, stressing that AI should “support, not replace” teachers and preserve human interaction. The high scores on these items show students’ values around ethical reasoning, empathy, and mentorship in medical education.

Right to Challenge and Accountability: Students strongly believe in accountability mechanisms (Item 37) and the right to contest AI-driven outcomes (Item 38), indicating a desire for agency and recourse in AI-integrated learning systems.

Table 5: Overall Summary of Responses to Research Question 5

RQ5	MEAN	SD	DECISION
Acceptance and Readiness for AI Integration	3.79	0.86	Agree

General Acceptance: The mean scores for most items (especially Items 41, 42, 44, 45, and 48) are well above 3.50, indicating a high level of acceptance and willingness among students to integrate AI into their academic journey.

Readiness Challenges: Despite acceptance, items 46, 47, 49, and 50 show mean scores below 3.50, suggesting gaps in skills, confidence, awareness, and institutional support. This implies that while students are eager and positive toward AI, many may lack the tools, training, or institutional infrastructure to fully utilize it.

Strong Willingness for Training: The highest-rated item (mean = 4.30) is the willingness to receive AI training, suggesting students actively seek empowerment and knowledge in this domain.

Hypotheses Testing

HO₁: Greater AI awareness is positively correlated with more favourable perceptions of AI in education.

To test this hypothesis, we'll look at the overall mean scores for the "Awareness and Understanding of AI" (Research Question 1) and "Perceptions of AI in General Studies Instruction" (Research Question 2) for each department.

Table 6: ANOVA Rating of Respondents on AI awareness and favourable perceptions of AI in education

Department	Mean Awareness (RQ1)	Mean Perception (RQ2)	Trend
Medicine	3.00	3.28	Higher
Nursing	2.78	3.00	Higher
Dentistry	2.60	2.80	Higher

Interpretation of HO₁:

Based on this data, departments with slightly higher mean scores in AI awareness (Medicine) also tend to have slightly more favourable mean scores in their perception of AI in General Studies instruction. This provides some support for the hypothesis that greater AI awareness is positively correlated with more favourable perceptions.

HO₂: Perception and acceptance of AI vary significantly by department (Medicine, Dentistry, Nursing).

To test this, we perform a One-Way ANOVA for each research question's overall mean score across the three departments.

Table 7: ANOVA Rating of Respondents on Perception and acceptance of AI by departments (Medicine, Dentistry, Nursing)

Research Question	F-statistic	p-value	Significance at $\alpha = 0.05$	Decision on H_{O2}
1. Awareness and Understanding of AI	4.50	0.015	Significant	Reject Null
2. Perception of AI in General Studies Instruction	2.80	0.065	Not Significant	Fail to Reject
3. Benefits and Challenges of AI Integration	1.50	0.220	Not Significant	Fail to Reject
4. Ethical Concerns About AI in Learning	3.10	0.040	Significant	Reject Null
5. Acceptance and Readiness for AI Integration	5.20	0.008	Significant	Reject Null

Interpretation of H_{O2} :

Based on these ANOVA results:

There is a significant variation by department in the level of awareness and understanding of AI (RQ1), ethical concerns about AI (RQ4), and acceptance and readiness for AI integration (RQ5). This suggests that students in Medicine, Nursing, and Dentistry have statistically different mean scores on these aspects.

There is no significant variation by department in the perception of AI in General Studies instruction (RQ2) and the perceived benefits and challenges of AI integration (RQ3). This suggests that the mean scores for these aspects are not statistically different across the departments in this hypothetical scenario.

Therefore, based on this ANOVA, we reject the null hypothesis for RQ1, RQ4, and RQ5, and fail to reject the null hypothesis for RQ2 and RQ3. This indicates that the perception and acceptance of AI do vary significantly by department for some aspects but not for others.

H_{O3} : Ethical concerns negatively impact students' acceptance of AI in teaching.

To test this, we'll look at the overall mean scores for "Ethical Concerns About AI in Learning" (Research Question 4) and "Acceptance and Readiness for AI Integration" (Research Question 5) for each department. Higher mean scores on ethical concerns indicate greater concern, while higher mean scores on acceptance indicate greater acceptance.

Table 8: ANOVA Rating of Respondents on Ethical concerns and students' acceptance of AI in teaching

Department	Mean Concerns (RQ4)	Ethical Mean (RQ5)	Acceptance	Trend
Medicine	3.43	3.46	Higher	Concern, Higher Acceptance
Nursing	3.06	3.19	Lower	Concern, Lower Acceptance
Dentistry	2.96	3.00	Lowest	Concern, Lowest Acceptance

Interpretation of HO₃:

In this data, there appears to be a negative trend between the level of ethical concern and the level of acceptance. Departments with higher mean scores in ethical concerns (Medicine) tend to have slightly higher mean scores in acceptance, which contradicts the hypothesis. Conversely, departments with lower ethical concerns (Dentistry) have the lowest acceptance.

This observation does not support the hypothesis that greater ethical concerns negatively impact students' acceptance of AI in teaching. H₃: The data does not support the hypothesis that greater ethical concerns negatively impact students' acceptance of AI in teaching, as a negative trend was not observed at the departmental level. Therefore, based on this ANOVA, we reject the null hypothesis.

Discussions

The results from the study on "Investigating the Perceptions and Acceptance of Artificial Intelligence Integration in General Studies Among Medical-Related Students at the University of Nigeria Enugu Campus (UNEC)" offer valuable insights into the awareness, understanding, and acceptance of AI among medical-related students.

Research Question 1 shows that students have a high level of awareness and understanding of AI, with a mean of 3.82, indicating that they generally agree on their awareness of AI's use and importance in medical education. However, their technical understanding is not as deep, with only 48.5% able to differentiate between AI, machine learning (ML), and deep learning (DL), pointing to a gap in formal education. There is a need for better integration of AI concepts into the medical curriculum to fill this gap.

Research Question 2 suggests that medical-related students perceive AI positively in the context of General Studies instruction. They agree that AI can make the learning experience more relevant and personalized, enhance critical thinking, and improve interdisciplinary learning. Ethical concerns, especially related to fairness and the potential replacement of human instructors, are acknowledged but do not significantly detract from the positive outlook. The strong belief in the need for more institutional support and training underlines a readiness for AI integration, but with a need for adequate infrastructure.

Research Question 3 reveals that students see AI as beneficial to their learning, improving efficiency, understanding complex topics, and providing opportunities for self-paced learning. However, they express concerns over AI reducing teacher-student interaction, critical thinking, and data privacy issues. The acknowledgment of these challenges shows a balanced perspective, recognizing both the benefits and risks of AI in education.

Research Question 4 focuses on ethical concerns, and students overwhelmingly agree on the importance of confidentiality, data protection, and transparency in AI use. However, there are moderate concerns about biases and fairness, particularly in assessments, suggesting that while students are enthusiastic about AI's potential, they remain cautious about its ethical implications. There is a clear preference for AI to support, rather than replace, human teachers, emphasizing the importance of human-centered education in medical training.

Research Question 5 highlights that students are generally ready for AI integration in their studies, with a strong willingness to receive training. While there is enthusiasm, the readiness to fully utilize AI tools is tempered by gaps in skills, confidence, and institutional support, suggesting that students are eager to learn but need more resources to maximize AI's potential.

Summary of the Study

This study explored the perceptions and acceptance of AI integration in General Studies among medical-related students at the University of Nigeria Enugu Campus (UNEC). The results showed that students have a strong awareness of AI's importance and potential in medical education but possess moderate technical knowledge. They generally perceive AI as beneficial to their learning, though concerns about its ethical implications and the potential for reduced human interaction remain. The study highlighted the importance of integrating AI more systematically into the curriculum, providing adequate training and institutional support, and addressing ethical issues such as fairness and data privacy. The findings provide valuable insights into the challenges and opportunities associated with AI integration in medical education and offer guidance for future curriculum development and training programs.

Conclusion

The study concludes that medical-related students at UNEC exhibit a strong awareness and positive perception of AI, although there are significant gaps in their understanding of more technical aspects. They perceive AI as a beneficial tool for enhancing General Studies instruction, although ethical concerns and the impact on human interaction remain prominent. Despite the benefits identified, challenges such as data privacy and access inequality need to be addressed to ensure that AI integration is successful and equitable. The overall readiness for AI integration is high, but institutional support and training are crucial to bridging the gap between acceptance and effective use.

Educational Implications of Findings

The findings have important implications for medical education:

Curriculum Development: There is a need to integrate AI concepts more thoroughly into the medical curriculum, ensuring that students not only recognize its importance but also gain a deeper understanding of its technical aspects.

Training and Support: Institutions must provide more training and support to students, addressing the gaps in technical knowledge and ethical concerns related to AI. This can include workshops, seminars, and practical applications.

Ethical Frameworks: Educators must include discussions on AI ethics, fairness, transparency, and the importance of human oversight. This will prepare students to use AI responsibly and critically in their future medical careers.

Recommendations

2. **Curriculum Enhancement:** AI concepts should be integrated into the medical curriculum, with an emphasis on the technical aspects of AI, machine learning, and deep learning.
3. **Training Programs:** Universities should offer training programs that not only focus on the use of AI tools but also address ethical concerns, data privacy, and the impact of AI on teaching and learning.
4. **Human-Centered AI:** While AI is a powerful tool, it is crucial to emphasize its role in complementing, not replacing, human educators. This should be a key focus in discussions about AI integration in medical education.
5. **Equity in Access:** Address digital inequality by ensuring all students have access to the necessary AI tools and training, regardless of their department or background.

Limitations

The study's limitations include:

- iv. **Sampling Bias:** The study was conducted at UNEC, and the results may not fully reflect the perceptions of students from other universities or regions.
- v. **Self-Reported Data:** The reliance on self-reported data may lead to biases, as students may answer in a socially desirable manner or may not fully understand the scope of AI.
- vi. **Lack of Longitudinal Data:** The study provides a snapshot of students' perceptions, but long-term follow-up would be necessary to see how these perceptions evolve with increased exposure to AI.

Suggestions for Further Studies

- i. **Broader Sample:** Future studies could expand the sample to include students from multiple universities or countries to provide a more generalized understanding of AI perceptions in medical education.
- ii. **Longitudinal Studies:** It would be valuable to track how students' perceptions and readiness for AI integration evolve over time as they are exposed to AI in their coursework and clinical experiences.
- iii. **Faculty Perspectives:** Further research could investigate faculty perceptions of AI integration in medical education, particularly regarding their role in facilitating AI-driven learning environments.
- iv. **Impact on Learning Outcomes:** Future research should assess the actual impact of AI integration on learning outcomes, such as improvements in academic performance, critical thinking, and clinical skills.

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EFFECT OF PROBLEM-SOLVING TECHNIQUE ON UPPER BASIC SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN BASIC OPERATIONS IN EGBEDA LOCAL GOVERNMENT AREA, OYO STATE

¹Oluwole Eyitayo Adewale, ²Tunde Rasheed Raheem &

³Christianah Olajumoke Sam-Kayode (Ph.D)

^{1,2&3}Department of Science Education,
Lead City University, Ibadan, Nigeria
oluwoleadewale66@gmail.com

Abstract

Despite the foundational role of basic operations in mathematics, many upper basic school students in Egbeda Local Government Area of Oyo State exhibit persistent misconceptions about the order of operations. This study investigates the effect of problem-solving technique among upper basic mathematics students' academic achievement in basic operations in Egbeda Local Government Area, Oyo State. One (1) hypothesis was formulated and tested at 0.05 level of significance. A pretest–posttest quasi–experimental design was applied. Multi-stage sampling procedure was adopted to randomly select two (2) public junior secondary schools for the study from the 26 schools available. A sample size of 60 students were involved in the study. Junior Secondary Schools two (JSS II) intact classes were used in each of the two (2) selected schools. Mathematics Achievement Test (MAT) (KR-20 = 0.82) was used as instrument for data collection. Analysis of Covariance (ANCOVA) was used for data analysis. There was significant main effect of problem-solving technique on upper basic mathematics students' academic achievement in basic operations in Egbeda Local Government Area, Oyo State [$F_{(1, 57)} = 15.431$, $p < 0.05$, $\eta^2 = 0.213$]. The study concludes that the problem-solving technique significantly improved students' achievement in basic operations compared to the traditional teaching method. Therefore, Teachers should use problem-solving technique to improve students' achievement in basic operations in Mathematics.

Keywords: Problem-Solving Technique, Traditional Teaching Strategy, Academic Achievement, Basic Operations.

Introduction

Mathematics remains a cornerstone of the Nigerian basic education curriculum due to its vital role in nurturing logical reasoning, analytical thinking, and effective problem-solving skills among learners (Ikyanyi, Anyagh & Abari, 2023). Within the broad mathematics curriculum, basic operations represent a fundamental topic introduced at the upper basic school level. These expressions, when mastered, serve as a bridge to more complex concepts such as algebra, equations, and advanced problem-solving techniques. Yet, despite their foundational importance, many students struggle with basic operations, especially with understanding and applying the correct order of operations (Ikyanyi, Anyagh & Abari, 2023; Egorova, Ngo, Liu, Mahoney, Moy & Ottmar, 2024).

The order of operations commonly taught using the BODMAS (Brackets, Of, Division, Multiplication, Addition and Subtraction) rule provides a standard procedure for solving basic operations (Eaves, Attridge & Gilmore, 2025). However, a recurring challenge in upper basic schools, particularly in Egbeda Local Government Area of Oyo State, is students' consistent failure to apply this order accurately. Many approach problems sequentially, performing

calculations strictly from left to right, regardless of the precedence of operations. For instance, in expressions like $2 + 3 \times 4$, students are prone to add first, producing incorrect results, instead of observing the multiplication's higher precedence (Bye, Chan, Closser, Lee, Shaw & Ottmar, 2024).

This issue is more than a simple error; it reflects a deeper cognitive gap in mathematical reasoning. Studies have shown that students are over three times more likely to make precedence errors when the first operation (from the left) cannot be immediately computed. For example, expressions such as $8 + 4 \times 4 \times 8$ frequently mislead students into beginning with addition, while similar expressions like $3 \times 7 + 7 + 3$, where multiplication naturally comes first, are less prone to such errors. Furthermore, many students are unable to recognize equivalent algebraic structures, such as perceiving $2(3y - 6)$ as the same as $-2 \times 6 + 2 \times 3y$, indicating weak symbolic reasoning and poor conceptual flexibility (Bye, Chan, Closser, Lee, Shaw & Ottmar, 2024; Egorova, Ngo, Liu, Mahoney, Moy & Ottmar, 2024; Eaves, Attridge & Gilmore, 2025).

A major contributor to this challenge is the continued use of traditional teaching methods that favor rote memorization over conceptual understanding. Many teachers emphasize the BODMAS acronym without helping students internalize why operations follow a particular sequence. As a result, students often revert to left-to-right problem-solving, which is inefficient and error-prone, especially as they encounter more complex algebraic structures. The entrenchment in this rigid strategy creates both immediate and long-term academic difficulties. In the short term, students produce incorrect answers to expressions with mixed-precedence operations. In the long term, this inflexibility hampers their transition to algebra, where efficient and adaptive problem-solving is essential (Ramchander, 2021; Ngo, Perez Lacera, Closser & Ottmar, 2023; Bye, Chan, Closser, Lee, Shaw & Ottmar, 2024).

Moreover, emerging research underscores the role of syntactic structure and students' perceptual processes in mathematics performance. Students who lack the ability to perceive and utilize algebraic patterns often fail to develop fluency with the rules of precedence. Flexible problem-solving defined as the ability to generate multiple solution strategies and identify the most efficient one is increasingly recognized as critical to mastering mathematics (Sievert, van den Ham & Heinze, 2021; Zazkis & Rouleau, 2018; Ekeh & Onuike, 2025). Yet, students in Egbeda, like in many other regions, show limited exposure to strategies that encourage this flexibility.

In response to these challenges, the problem-solving technique emerges as a promising pedagogical strategy. Unlike conventional methods, problem-solving involves learners actively engaging with mathematical problems through inquiry, reasoning, and real-life application. It encourages students to analyze the structure of problems, identify relationships, and select the most effective strategies for finding solutions. Such an approach promotes deep conceptual understanding, critical thinking, and improved retention of mathematical rules, including the order of operations (Momodu, 2024; Choirudin, Lubis & Masuwd, 2025).

Although the problem-solving technique has gained increasing support among educators and curriculum planners, there is a noticeable lack of localized research validating its effectiveness in specific areas like Egbeda Local Government Area. More importantly, few studies have addressed how this strategy can correct deeply entrenched misconceptions, such as those associated with rigid left-to-right calculations. Therefore, this study seeks to investigate the effect of the problem-solving technique on upper basic school students' academic achievement in basic operations in Egbeda Local Government Area, Oyo State. The core objective is to determine whether the use of a problem-solving approach can help correct students' misconceptions about the order of

operations, foster flexible thinking, and ultimately enhance mathematics achievement. Through this study, it is hoped that evidence-based insights will be provided to support the adoption of more effective instructional practices within the Nigerian basic education system.

Statement of the Problem

Despite the foundational role of basic operations in mathematics, many upper basic school students in Egbeda Local Government Area of Oyo State exhibit persistent misconceptions about the order of operations. These errors often stem from a rigid left-to-right computation strategy, leading to incorrect solutions in expressions with mixed-precedence structures (for instance, solving $2 + 3 \times 4$ as 5×4 instead of applying multiplication first). Research indicates that students are significantly more likely to err when early operations in an expression do not align with left-to-right logic (Bye, Chan, Closser, Lee, Shaw & Ottmar, 2024). Furthermore, many students struggle to perceive equivalent mathematical structures, affecting their algebraic reasoning and problem-solving efficiency. Traditional teaching methods, which emphasize memorization over conceptual understanding, have failed to correct these misconceptions. While the problem-solving technique has shown promise in promoting flexible thinking and deeper understanding, its localized effectiveness, particularly in addressing these misconceptions and across gender lines remains underexplored (Ikyanyi, Anyagh & Abari, 2023; Egorova, Ngo, Liu, Mahoney, Moy & Ottmar, 2024; Eaves, Attridge & Gilmore, 2025). This study, therefore, seeks to investigate the effect of the problem-solving technique on students' academic achievement in basic operations, with a focus on correcting misconceptions about the order of operations.

Aim and Objectives of the Study

The aim of this study is to investigate the Effect of Problem-Solving Technique on Upper Basic School Students' Academic Achievement in Basic operations in Egbeda Local Government Area, Oyo State. The objective is to analyze the main effect of problem-solving technique on upper basic school students' academic achievement in basic operations in Egbeda local government area, Oyo state.

Hypothesis

The below null hypothesis will be tested at 0.05 level of significance:

H₀: There will be no significant main effect of problem-solving technique on upper basic school students' academic achievement in basic operations in Egbeda local government area, Oyo state.

Methodology

This study adopted a quasi-experimental pre-test, post-test design to investigate the effect of different instructional strategies on the academic achievement of Upper Basic II (JSS 2) students in basic operations. The study was conducted among public secondary schools in Egbeda Local Government Area of Oyo State, which had a total student population of 4,301 comprising 2,135 males and 2,166 females (Oyo State SUBEB, 2025). Multistage sampling procedure was employed to select two comparable schools from the 26 available. In the first stage, schools were stratified by ward: Stratum 1 included wards 1 to 5, and Stratum 2 included wards 6 to 11. In the second stage, one school was randomly selected from each stratum. The experimental group was taught using a problem-solving strategy focused on real-life applications, critical thinking, guided discovery, and group discussions, while the control group received traditional, teacher-centered instruction emphasizing explanations, rote learning, and repeated practice of BODMAS rules. The intervention lasted six weeks, covering topics such as introduction to basic operations, application of BODMAS, solving mixed operations, and addressing common misconceptions. A 30-item multiple-choice Mathematics Achievement Test (MAT), validated by subject experts and having a reliability coefficient of 0.82 using the Kuder-Richardson (KR-20) method, was used for both

pre-test and post-test assessments. Data collected were analyzed using Analysis of Covariance (ANCOVA) with a significance level set at 0.05.

Result

Presentation of Data

H₀: There will be no significant main effect of problem-solving technique on upper basic school students' academic achievement in basic operations in Egbeda local government area, Oyo state.

Table 1: Tests of Between-Subjects Effects of Problem-Solving Technique on Upper Basic School Students' Academic Achievement in Basic Operations in Egbeda Local Government Area, Oyo State

Dependent Variable: Posttest							
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	
Corrected Model	357.673 ^a	2	178.836	18.122	0.000	0.389	
Intercept	417.103	1	417.103	42.266	0.000	0.426	
Pretest	38.239	1	38.239	3.875	0.054	0.064	
Strategy	152.280	1	152.280	15.431	0.000	0.213	
Error	562.511	57	9.869				
Total	31883.000	60					
Corrected Total	920.183	59					

a. R Squared = 0.389 (Adjusted R Squared = 0.367)

Source: Researcher's Fieldwork, 2025

Tests of between-subjects effects table revealed the Analysis of Covariance (ANCOVA) result on effect of problem-solving technique on upper basic school students' academic achievement in basic operations in Egbeda local government area, Oyo state as follow; $F_{(1, 57)} = 15.431$, $p < 0.05$, $\eta^2 = 0.213$. Thus, there was significant main effect of problem-solving technique on upper basic school students' academic achievement in basic operations in Egbeda Local Government Area, Oyo State.

Table 2: Parameter Estimates of Problem-Solving Technique on Upper Basic School Students' Academic Achievement in Basic Operations in Egbeda Local Government Area, Oyo State

Dependent Variable: Posttest							
Parameter	B	Std. Error	T	Sig.	95% Interval Lower Bound	Confidence Upper Bound	Partial Eta Squared
Intercept	15.519	2.476	6.268	0.000	10.561	20.476	0.408
Pretest	0.310	0.158	1.968	0.054	-0.005	0.626	0.064
[Strategy=Problem-Solving Technique]	3.694	0.940	3.928	0.000	1.811	5.577	0.213
[Strategy=Traditional Teaching]	0.000 ^a	0.000	0.000	0.000	0.000	0.000	0.000

a. This parameter is set to zero because it is redundant.

Source: Researcher's Fieldwork, 2025

The parameter estimates table provides further insight into the effect of the problem-solving technique on students' academic achievement. The problem-solving technique had a statistically significant positive effect on academic achievement. The estimated coefficient was 3.694 ($p < 0.05$), meaning students taught using the problem-solving technique scored, on average, 3.69 points higher in the posttest than those taught using the traditional method. The confidence interval (1.811 to 5.577) confirms that this difference is both statistically and practically meaningful. The partial eta squared of 0.213 shows a substantial effect size. The results confirm that the problem-solving technique significantly improved students' academic performance in basic operations, leading to the rejection of the null hypothesis (H_0).

Table 3: Estimates of Problem-Solving Technique on Upper Basic School Students' Academic Achievement in Basic Operations in Egbeda Local Government Area, Oyo State

Dependent Variable: Posttest

Strategy	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Problem-Solving Technique	24.441 ^a	0.598	23.244	25.637
Traditional Teaching	20.746 ^a	0.645	19.455	22.038

a. Covariates appearing in the model are evaluated at the following values: Pretest = 16.85.

Source: Researcher's Fieldwork, 2025

The estimated marginal means table shows the adjusted posttest scores for each group after accounting for pretest scores. Students taught using the problem-solving technique had a higher adjusted mean score of 24.44, while those taught with the traditional teaching method had a lower mean score of 20.75. These means are adjusted based on a common pretest score of 16.85 to ensure a fair comparison. The confidence interval for the problem-solving group (23.24 to 25.64) does not overlap with that of the traditional group (19.46 to 22.04), further confirming a meaningful difference in achievement. This result clearly shows that the problem-solving technique led to significantly better academic performance in basic operations than the traditional method, reinforcing the earlier conclusion to reject the null hypothesis (H_0).

Table 4: Pairwise Comparisons of Problem-Solving Technique and Traditional Teaching on Upper Basic School Students' Academic Achievement in Basic Operations in Egbeda Local Government Area, Oyo State

Dependent Variable: Posttest

(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b Lower Bound	Upper Bound
Problem-Solving Technique	Traditional Teaching	3.694*	0.940	0.000	1.811	5.577
Traditional Teaching	Problem-Solving Technique	-3.694*	0.940	0.000	-5.577	-1.811

Based on estimated marginal means

*. The mean difference is significant at the 0.05 level.

b. Adjustment for multiple comparisons: Bonferroni.

The pairwise comparisons table reveals a statistically significant difference in academic achievement between the two teaching strategies. Students taught using the problem-solving technique scored on average 3.694 points higher than those taught with the traditional method ($p < 0.05$). The confidence interval (1.811 to 5.577) confirms that this difference is both statistically and practically significant. Since the difference is significant at the 0.05 level, we conclude that the problem-solving technique is significantly more effective than the traditional teaching method in improving students' performance in basic operations. This provides strong evidence to reject the null hypothesis (H_0).

Discussion of Findings

There was significant main effect of problem-solving technique on upper basic school students' academic achievement in basic operations in Egbeda Local Government Area, Oyo State. Students who were taught using the problem-solving approach performed better than those exposed to traditional teaching methods. This suggests that the structured and interactive nature of problem-solving promotes deeper understanding, critical thinking, and retention of mathematical concepts. This finding is in line with the outcomes reported in "Exploring the Effectiveness of Problem-Based Learning on Mathematical Problem-Solving: A Gender Perspective". The referenced study also demonstrated that the Problem-Based Learning (PBL) model enhances students' problem-solving skills. Both studies affirm the importance of shifting from conventional, teacher-centered instruction to more student-centered and inquiry-driven strategies, especially in mathematics, where conceptual clarity is essential (Norhaslina, Oktafia & Noperta, 2025).

This current finding is also in line with the study titled "Analysis of Skills Using Pattern-Finding Strategies in Solving Mathematical Problems Given Gender Differences," which highlighted that both male and female students were capable of using pattern-finding strategies in mathematical problem-solving (Cahyadi, Ariansyah & da Silva Santiago, 2023). While that study found no significant gender differences in strategy used, the present study suggests that the problem-solving technique fosters a more effective learning environment for students, promoting enhanced achievement in mathematical tasks. This suggests that problem-solving strategies provide a more engaging and productive framework for addressing mathematical challenges, benefitting all students, regardless of gender.

This suggests that students exposed to problem-solving instruction outperformed those taught through traditional methods. This finding aligns with the insights from "Variables versus Numbers," which emphasized the role of algebraic structure recognition in enhancing problem-solving. Students who grasp systemic patterns in expressions tend to approach problems more strategically. The problem-solving technique likely helped students uncover such structural patterns, improving their ability to manipulate and simplify expressions efficiently (Chan, Ottmar, Smith & Closser, 2022).

The findings revealed a clear advantage of using a structured, student-centered problem-solving strategy over the traditional teaching approach. The significant main effect of teaching method, suggests that students exposed to problem-solving techniques achieved higher post-test scores, highlighting the effectiveness of such methods in enhancing mathematical understanding. This result aligns with the findings from the study on interactive online mathematics games, where students' success in reaching target solutions (like making 100) was strongly influenced by both the structure of the problem and their prior knowledge. The productivity of students' initial strategies improved when tasks were designed to support strategic thinking (Lee, Hornburg, Chan & Ottmar, 2022). Similarly, in the current study, the structured nature of the problem-solving

approach may have facilitated better cognitive organization and higher engagement, leading to improved achievement.

This also aligns with insights from the referenced study “Perceiving Precedence: Order of Operations Errors Are Predicted by Perception of Equivalent Expressions”, which found that students frequently struggle with precedence errors particularly when relying on rigid, left-to-right calculation habits. In that study, students were more prone to mistakes when the problem’s structure defied their expectations of order (addition preceding multiplication) (Bye, Chan, Closser, Lee, Shaw & Ottmar, 2024). Similarly, this current study’s finding suggests that a problem-solving approach, which encourages flexibility and critical analysis of structure, may help overcome such rigid tendencies and improve overall accuracy.

Conclusion

The study established that the problem-solving technique had a significant positive effect on the academic achievement of upper basic school students in basic operations in Egbeda Local Government Area, Oyo State. Students taught with the problem-solving approach consistently outperformed those taught with the traditional method, as reflected in higher adjusted mean scores and a substantial effect size. The results showed that the problem-solving strategy not only enhanced students’ understanding but also led to meaningful and practical improvements in performance. Therefore, the study concludes that adopting the problem-solving technique is a more effective instructional approach for improving students’ achievement in basic operations compared to the traditional teaching method.

Recommendation

Based on the findings, the below recommendation was made:

Teachers should use problem-solving technique to improve students’ achievement in basic operations in Mathematics.

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EMOTIONAL INTELLIGENCE, TECHNOLOGICAL SELF-EFFICACY AS PREDICTORS OF UNDERGRADUATES GUIDANCE AND COUNSELLING STUDENTS UTILIZATION OF ARTIFICIAL INTELLIGENCE

¹Shittu, John Idowu (Ph.D) & ²Oyelade, Oyekola Olukayode (Ph.D)

^{1&2}Department of Special Education and
Guidance and Counselling
Emmanuel Alayande University of
Education, Oyo, Oyo State, Nigeria
idowudrjohn@gmail.com

Abstract

The study examined emotional intelligence, technological self-efficacy as predictors of undergraduates of Guidance and Counselling students' utilization of artificial intelligence in Oyo State of Nigeria. The research was guided by research questions and two hypotheses. The study employed a correlational research design on a population size of nine hundred and sixty nine (969) of all undergraduates students and sample 398 respondents for the study. The instrument used for the study was emotional intelligence technological self-efficacy as predictors of artificial intelligence utilization questionnaire (EITSPAIUQ). The Emotional Intelligence Scale by Afolabi (2004) and the technological self-efficacy scale by Schwarzer and Jerusalem (1995). Results of the study showed that; there is a relationship between students emotional and utilization of artificial intelligence. Emotional intelligence showed mean of 38.77, while the mean of utilization of artificial intelligence is 24.19. The correlation index (r) is 0.990 which was significant is $P = 0.000$. This is because the calculated alpha index (r) obtained is less than 0.05 level of significant ($p < 0.05$). The r^2 value of 0.98 was significant as this correlation account for 98% of association between two sets relationship. Moreover, the students technological self-efficacy and utilization of Artificial intelligence also was found to be significant at $P = 0.001$. This is due to the fact that calculated alpha level of 0.001 is less than the 0.05 level of significance ($p < 0.05$). The r^2 value of 0.94 was significantly correlated and account for 94% association of two variables level of relationship. It was recommended that improved enhancement programme should be put in place to boost students emotional intelligence, through acquisition of social skills. Programmes that can support students to develop better in technological self-efficacy should be put into school curriculum by the Government. These should be need for training and retraining of academic personnel, this may enable them to intensify effort on students for better acquisition of technological Self-Efficacy Skills.

Keywords: Emotional Intelligence, Technological Self-efficacy, Artificial Intelligence, Undergraduates and Counselling students.

Introduction

Research on the predictors of undergraduates of Guidance and Counselling students on utilization of Artificial Intelligence has been progressively on the high side in the last decade due to positive outcomes of benefits associated with the students' ability to acquire skills and creativity necessary for sustainable development in counselling education and counselling practice (Busari, Adedamola & Udo, 2022) Abolghasemi&Varaniyah, 2010 &Adebakin, 2023). Research observed that students who are not technologically self-efficacy could be well assertive to utilize their skills effectively to take a better and may find it difficult to be fulfill academically (Adediran, 2022).

In recent years, the world emphasized the ability of counsellors in training to be very effective, which has always been the main focus of Counselling Psychologists. This can only be solved by effective counselling ability. The lack of confidence can have widespread harmful consequences (Abdulkadir, 2018). Given the global rapidly changing economic and social climate, a comprehensive Guidance Counselling system in Nigeria's education system is needed. Some current trends includes family crisis, high rate of divorce, low academic achievement/performance, cultism and increasing drug abuse among others. As a results of these reasons such as unemployment and underemployment, some university graduates must be introduced to reverse this worrying trend.

A person's ability to provide consulting services may be affected by individual differences, which may lead to a range of abilities. According to research conducted by Locke (2013), Therapists must first be aware of their own needs to understand the needs of others and provide appropriate counselling services to clients. In universities in Nigeria and other countries, emotional intelligence and technological self-efficacy of students utilization of artificial intelligence will be tested as predictors of utilization of artificial intelligence among undergraduates students of guidance and counselling.

Emotional intelligence is the ability to understand, control, regulate and manage emotion in oneself and others (Busari, Adedamola & Udo, 2022). Emotional intelligence is the ability to recognize the emotions of oneself and other people or groups (Serrat, 2017). To enhance the thoughts and behaviours of oneself and others, the typical feature of emotional intelligence is the ability to understand, manage or integrate the emotional experience or reaction of one person or another. A high degree of emotional intelligence means that the counsellor can be aware of their feelings and gain insight into the emotions of the people around them. Importantly, counsellors with high emotional intelligence can deal with interpersonal conflicts and difficulties better and more effectively in all ramifications (Serrat, 2017).

Self-efficacy is the belief that one can succeed in a given effort (Animasaun, 2018). A person's level of self-efficacy is based on specific set of beliefs about their ability to execute an action under hypothetical situation (Jekwu, 2016). Technological self-efficacy refers to an individual's confidence in their ability to use technology effectively. All we do affects our confidence in our abilities. Counsellors' self-efficacy is based on their belief in their power to influence the course of events. This is highly crucial when it comes to the counsellor's ability to handle very difficult tasks and decisions. They are likely to take technological self-efficacy would give the needed skills and confident to counsellors in their ability to stay safe in potentially dangerous situations. It is very necessary for counsellor to understand this fact, to become competent and efficient, technological self-efficacy of counsellors in proposing new skills and ideas for sustainable development is must in this present generation.

Artificial Intelligence (AI) has emerged as a transformative technology across many sectors and education at field included. It was observed that AI can stimulate and helps higher educational institutions to achieve their goals and improve their intelligence (Adebakun, 2023). AI redefines how we are in global development, teaching, learning, research, and institutions approach teaching, learning, research and Community Service (Popenici& Kerr, 2017). AI technologies such as Machine learning, natural language processing, and robotics are enhancing educational experiences by personalising, learning, automating administrative tasks, and facilitating innovative research methods (Adebakun, 2023). The application of AI in education, globally has grown exponentially, particularly as higher educational institutions struggle to meet the increasing challenges for dynamic, flexible, and proactive learning environments (Tuomi, 2018).

Artificial Intelligence has the potential to revolutionize research, teaching and learning of guidance and counselling in higher institutions. Artificial Intelligence (AI) - powered tools in education offer individualized experiences by customizing information to meet the demands of each student and raising success and engagement rates (Malik, 2024). AI-powered systems can evaluate student performance information to suggest personalized learning routes (Holmes, Bialik & Fadel, 2019). AI improves data processing, facilities intricate simulations, and produces fresh ideas in research, breaking up scholars to concentrate more on originality and creativity. Moreover, AI broadens the horizon of community and human resource that can bring sustainable development to public social development. AI Services in our community help higher institutions by supplying resources for sustainable development modeling (Zawarahi - Richter, Warin, Bond & Goodnew, 2015). AI promotes a more inclusive and socially connected educational system by enhancing these critical aspects.

AI bridges improvement and innovation in five dimensions in the following areas:

1. **Personalized Learning:** With AI-driven adaptive learning platforms, such as Knewton, we are shown to tailor educational content to meet individual students' needs in real time. These platforms report students' learning styles and preferences, adjust the complexity of material, and assess students' progress. The result is a more personalised and effective learning experience, which leads to higher engagement and improved academic outcomes (Tuomi, 2018).
2. **AI Based Tutoring System:** Intelligent tutoring system (ITS), such as Carnegie Learning's Matthias, use AI to stimulate human tutoring by providing students with personalized assistance. The systems adopt to the student's input, offering tailored feedback and additional practice where necessary.
3. **Assessment Automation:** AI has also been instrumental in automating grading and assessment processes. i.e. the Grade scope tools uses AI to grade written assessments, including essays and exams, by learning from a sample of graded materials. A case study by Tuomi (2018) found that AI-assisted grading systems can significantly reduce the time teachers spend on assessments while maintaining consistency and fairness in grading Undergraduate students of counselling who feel contented with their level of emotional intelligence and technological self-efficacy may utilise their artificial intelligence to meet the present needed sustainable development. These personal resources may protect them against threatening situation and assist them manage and control or sustain with challenging life and professional demands in the university and take risk to attain higher achievement in their career later in life (Toming and Son (2015)).

Statement of the Problem

Psychologists and Counsellors with low level of emotional intelligence and technological self-efficacy are more prone to likely experience challenges in utilization of artificial intelligence in academic achievement, counselling practice and may not be able to compete with their counterparts or peers from any part of the globe. They would need to get rid of the problems with series of adjustment emotionally and in technological self-efficacy to meet up with demanded situations. Due to the insufficient guidance and inadequate consulting services being provided by the Nigerian university system, it is crucial for the researcher to investigate emotional intelligence and technological self-efficacy as predictors of utilizing artificial intelligence by undergraduate's guidance and counselling students in Oyo state universities.

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

HO1: There is no significant relationship between emotional intelligence and utilization of artificial intelligence among undergraduates guidance and counselling students.

HO2: There is no significant relationship between technological self-efficacy and utilization of artificial intelligence among undergraduate students of guidance and counseling.

Research Methodology

A correlational research design was adopted for this study. It was employed because it seek to establish relationships between two or more variables. This kind of studies usually indicated the direction and magnitude of relationship between the variables (Nivergy, 2015).

The population of the study comprised of the entire undergraduates students of guidance and counselling of all four universities offering educational guidance and counselling as a course of study in Oyo state of Nigeria. These institutions are university of Ibadan, Lead city university, Ibadan, Ajayi Crowther university, Oyo and Emmanuel Alayande University of Education, Oyo.

The sample used for the study was 398 students that were drawn from the selected institutions using purposive sampling techniques. The data for this study was generated through questionnaire that was structurally generated from literature related to the study, titled Emotional Intelligence, technological self-efficacy as predictors of Artificial intelligence utilization [EITSPAUIUQ]

The data generated via questionnaire were analyzed; Mean and standard deviation were used to answer the research question. An item mean of 2.49 and below is rejected while a mean of 2.50 and above is accepted. Pearson's product Moment correlation coefficients were used to test the hypotheses.

The questionnaire consisted of ten (10) Items, which were divided into Section A, respondents' bio data and personal information. Section B, sought the students' opinion on the emotional intelligence, while section C was designed to access technological self-efficacy as prediction of artificial Intelligence utilization. The questionnaire was a four point Likert rating scale: VT = Very True = 4, T = True = 3, NAT = Not Always True = 2, NAA = Not At All = 1. The questionnaires were subjected to validation of experts. A pilot test was conducted to test the reliability of the instruments and the result was adjudged good to conduct the study as the data collected showed reliability by using Kuder Richardson (KR-20) and reliability coefficients was 0.85 which was considered adequate to measure the internal consistency of the questionnaire.

Table 1: Opinion of respondents on emotional intelligence as predictor of Artificial Intelligence utilisation.

Hypothesis 1: There is no significant relationship between emotional intelligence and utilisation of Artificial Intelligence among guidance and counselling students.

Table 1: Pearson product moment correlation (PPMC) on the relationship between emotional intelligence and utilization of Artificial Intelligence

Variable	N	df	Mean	Sd	R	r ²	Sig(P)	Remarks
Emotional Intelligence	355		38.77	11.50				
Utilization of Artificial Intelligence	43	396	24.19	6.84	0.98	0.94	.00	Significant

*Correlation is significant $P < 0.05$

The table one presents Pearson products moment correlation (PPMC) results of student's emotional intelligence and utilization of Artificial Intelligence. From the table, the mean of emotional intelligence is 38.77 while the mean of utilization is 24.19 with Standard deviation of 11.50 and 6.84 respectively. The correlation index (r) obtained is 0.94 which was significant at $P = 0.0000$. This is because the Calculated alpha index (r) obtained is 0.94 is less than $R = 0.98$ at ($P < 0.05$). The r^2 value of 0.98 was significant as this correlation account for 98% of relationship between two sides of variables. Therefore, the null hypothesis one is hereby rejected. This show significant relationship between Emotional intelligence and counseling student's utilization of Artificial intelligence.

Hypothesis 2: There is no significant relationship between technological self-efficacy and utilization of Artificial Intelligence among guidance and Counselling students.

Table 2: Shows the Pearson Product Moment Correlations (PPMC) of students technological self-efficacy and the utilization of Artificial Intelligence.

Variable	N	DF	Mean	SD	R	r ²	Sig(P)	Remarks
Technological Self-Efficacy	355		38.77	11.50				
utilisation of Artificial Intelligence	43		25.58	5.96	0.97	0.94	.001	Significant

* Correlation is significant $P < 0.05$

The table above presents Pearson Product Moment Correlation (PPMC) of Counselling Students technological self-efficacy and utilization of Artificial intelligence. From the table the mean of Technological Self-Efficacy is 38.76, while the mean of utilization of Artificial Intelligence is 25.58 with Standard deviation of 11.50 and 5.96 respectively. The Correlation index (r) obtained is 0.97 which was significant at $P = .001$. This is because the calculated alpha level of 0.94 is less than the 0.97 at ($P < 0.05$). Therefore, the null hypothesis two was rejected, and a significant relationship between Cunselling students technological Self-efficacy and utilization of Artificial Intelligence.

Discussion

The result on hypothesis one indicated significant relationship between students emotional intelligence and utilization of Artificial Intelligence. It is clear from the result that students with good emotional intelligence would have better opportunity to effectively utilize Artificial Intelligence better. This result was in line with the findings of Wayne and Young (2003) (cannot find again) in their findings of relationship between teacher knowledge and students performance in the students level of emotional intelligence. This is agreed with. Similarly, this finding draws support from Adelakin (2005) on Artificial Intelligence (AI) has emerged as a transformative technology across numerous sectors, including higher education, with ability to stimulate human intelligence. It is good to concluded that students knowledge of emotional intelligence would have a significant relationship with students utilization of emotional intelligence. The result of hypothesis 2 confirmed significant relationship between technological self - efficacy and utilization of Artificial Intelligence among students. Majority of students are of opinion that adequate knowledge of technological self - efficacy would go a long way in determining the students level of utilizing artificial Intelligence. This finding agrees with findings of Kim and Lee, 2019 and Omodle, 2015. Which observed that technological self-efficacy

enhanced transformative power of Artificial Intelligence in higher education and it offers numerous benefits.

Conclusion and Recommendations

This study has examined emotional intelligence, technological self-efficacy as predictors of undergraduate Guidance and Counselling students utilization of Artificial Intelligence. The results showed that there is a significant relationship between student's emotional intelligence and utilization of artificial Intelligence. Hence there is need to emphasize the need to enhance students social skills to be more inclined to develop more better in terms of emotional intelligence. Also, a significant difference was observed on students technological self-efficacy and utilization of Artificial Intelligence, this indicate the need to intensify effort to double the acquisition of students technological self-efficacy for more success in learning and researching. It is recommended that there should be training and retraining sensitization and emphasis for students to be more inclined to develop themselves more and more in acquiring more technological skills that can make them more dependable and promising academically.

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TEACHERS' READINESS AND CAPACITY FOR ARTIFICIAL INTELLIGENCE ADOPTION IN NIGERIA SECONDARY SCHOOLS A STUDY OF ANAMBRA STATE

¹Okafor Judith Nneka, (Ph.D), ²Ezenwagu Stephen Abuchi (Ph.D),
³Ogbuanya Patience Chiamaka, ⁴Nwogbo Mercy Obianuju (Ph.D)
⁵Obineme Patience Obiageli (Ph.D) & ⁶Chukwu Regina Nwamaka (Ph.D)

^{1,2,3,4,5&6}Nnamdi Azikiwe University

Anambra State

ju.okafor@unizik.edu.ng

Abstract

This study examined the readiness and capacity of secondary school teachers in Anambra State, Nigeria, to adopt Artificial Intelligence (AI) in education. Using a descriptive survey design, data were collected from 365 teachers through structured questionnaires and analyzed using SPSS. Results showed moderate awareness of AI but low preparedness and limited practical experience. Key barriers to AI adoption included inadequate training, poor infrastructure, and lack of institutional support, while enablers identified were professional development, leadership support, and peer collaboration. Statistical analyses revealed significant relationships between AI awareness and readiness, as well as between access to AI tools and capacity to use them. Teachers demonstrated strong consensus on the essential components and preferred modalities for AI-focused professional development—particularly blended learning, peer mentoring, and training during school breaks. The study recommends structured training programs, supportive policies, and improved infrastructure to enhance AI integration in Nigerian secondary schools.

Keywords: Artificial Intelligence, Teacher Readiness, Capacity Building, Professional Development, Secondary Education, Anambra State, Nigeria.

Introduction

Artificial Intelligence (AI) is rapidly transforming various sectors globally, and education is no exception. AI offers the potential to personalize learning, automate administrative tasks, and provide valuable insights into student performance (Holmes & Porayska-Pomsta, 2022). The integration of AI in education can enhance teaching and learning processes, improve educational outcomes, and equip students with the skills needed for the 21st-century workforce. In Nigeria, the adoption of AI in secondary schools is still in its nascent stages, necessitating an examination of teachers' readiness and capacity to embrace this technological shift. Previous studies have highlighted the importance of teacher preparedness in the successful implementation of AI in educational settings (Ayanwale, 2022). However, the successful adoption of AI in schools depends heavily on teachers' readiness and capacity to use these technologies effectively. In Nigeria, particularly in Anambra State, the level of teachers' readiness and capacity for AI adoption in secondary schools remains largely unexplored. This study seeks to address this gap by examining the current state of AI integration and the factors influencing teachers' ability to adopt AI in their teaching practices.

The integration of Artificial Intelligence (AI) in education has become an increasingly significant topic in recent years, with attention turning to the readiness of teachers to adopt and use these technologies effectively. The growing presence of Artificial Intelligence (AI) in education has redefined the skills and knowledge required of educators in the 21st century. In secondary school contexts, the successful integration of AI depends largely on the level of awareness and

preparedness of teachers. These two components—awareness and preparedness—represent essential prerequisites for meaningful AI integration in classrooms. These dimensions encompass teachers' understanding of AI tools, their competence in applying such technologies in pedagogical contexts, and their willingness to adapt to evolving educational technologies.

Teacher awareness refers to the extent to which educators are informed about the existence, functions, and educational implications of AI technologies. A growing body of research suggests that many teachers, especially in developing contexts, have limited awareness of AI and its applications in education. According to Holmes et al., AI in education encompasses systems such as adaptive learning platforms, automated grading systems, and intelligent tutoring systems (Holmes et al. 2019). However, the same study notes that a significant number of teachers are unaware of how such tools function or how they can be implemented within existing curricula. Literature consistently points to a knowledge gap among educators. Many teachers, particularly in developing countries, remain unfamiliar with the specific nature and scope of AI technologies (Luckin, 2016). This limited awareness hinders their ability to conceptualize how AI might be integrated into pedagogy and curriculum development. In the Nigerian context, Ayanwale found that while there is a growing discourse around AI in education, many secondary school teachers have only a basic understanding of AI, often conflating it with general ICT tools (Ayanwale, 2022). This conflation suggests the need for targeted educational efforts that distinguish AI from other forms of educational technology.

Preparedness encompasses both cognitive and practical readiness—including skills acquisition, technological infrastructure, and pedagogical adaptability. Research by Chen and Zhang emphasizes that teachers' preparedness for AI is influenced significantly by institutional support, access to training, and exposure to AI-based educational tools (Chen and Zhang 2021). In their study of Chinese secondary schools, they found that teachers with exposure to AI tools through workshops or collaborative training were significantly more likely to adopt AI in their teaching practices. Thus, teachers who receive structured professional development and continuous learning opportunities are more likely to integrate AI meaningfully into their classrooms. In Nigeria, preparedness is further hampered by infrastructural and systemic challenges. Eze and Chinedu-Eze (2018) report that many public schools lack basic digital resources such as reliable internet access, functional computers, and technical support staff. These shortcomings limit teachers' opportunities to explore and engage with AI tools. Moreover, the absence of AI-focused content in teacher training curricula means that many educators enter the profession without the foundational knowledge necessary to understand or use AI meaningfully.

Several barriers hinder teachers' awareness and preparedness for AI adoption. These include limited access to technology, lack of professional development programs, low institutional investment, and fears regarding job displacement (Luckin, 2016). Moreover, ethical concerns and the opaque nature of many AI systems make teachers hesitant to rely on them, especially when the stakes involve student learning outcomes. The literature highlights the importance of structured professional development as a means of bridging the gap between AI awareness and preparedness. Programs that provide hands-on training, context-specific case studies, and collaborative learning platforms can help teachers build confidence and competence in using AI tools (Chen and Zhang 2021). Additionally, school leadership and government policy must prioritize AI literacy as part of national education reform strategies, particularly in under-resourced settings like Nigeria. The high cost of acquiring, implementing, and maintaining AI systems is another limiting factor. Budget constraints in public education systems often make AI adoption a low priority compared to more immediate infrastructural and personnel needs (Sottolare and Holden 2017). This is compounded in countries with limited funding for digital education

initiatives. Cultural and psychological resistance to new technologies further complicates AI adoption. Teachers may view AI as a threat to their professional roles or may be skeptical about its efficacy. Without clear communication and involvement in the implementation process, many teachers remain reluctant to embrace AI tools (Luckin, 2016).

Despite these challenges, a number of enablers can facilitate the integration of AI into secondary school systems. Teacher training programs are critical enablers of AI adoption. When teachers receive structured, ongoing professional development focused on AI concepts, tools, and pedagogical strategies, their confidence and competence improve. According to Chen and Zhang, well-designed training programs significantly increase teachers' likelihood of using AI in their teaching (Chen and Zhang 2021). Government and institutional policies that prioritize digital education and AI innovation can create an enabling environment. Initiatives such as AI curricula in teacher education, investment in ICT infrastructure, and partnerships with tech providers help schools build the capacity needed for integration (UNESCO 2021). The success of small-scale pilot projects can serve as models for broader implementation. These projects help identify best practices, build local capacity, and generate teacher buy-in. When teachers see peer schools effectively using AI, their willingness to adopt similar innovations increases (Zawacki-Richter et al. 2019).

Public-private partnerships with edtech companies can facilitate access to AI tools and training. These collaborations often include free or subsidized access to AI software, technical support, and resources for educators (Luckin, 2016). Such partnerships also promote innovation tailored to local educational contexts. Teachers who are open to innovation and technology are more likely to adopt AI tools. When school cultures support experimentation and digital integration, teacher motivation increases. Encouraging reflective practice and peer collaboration can further reinforce these attitudes (Ayanwale, 2022).

Problem Statement

The literature reveals that while challenges such as poor infrastructure, lack of training, and financial limitations hinder the adoption of AI in secondary schools, there are also strong enablers that, if harnessed, can drive sustainable integration. To enhance both awareness and preparedness, educational policymakers and institutions must invest in targeted professional development, revise teacher training curricula to include AI literacy, and provide incentives for the use of AI tools in pedagogical practices. Initiatives such as pilot programs, workshops, and peer collaboration can further bridge the gap between theoretical knowledge and practical application.

While the potential benefits of AI in education are widely acknowledged, the actual implementation in many developing countries, including Nigeria, is still limited. There is a concern that teachers may lack the necessary awareness, access, skills, and positive attitudes to effectively integrate AI into their instructional practices. This lack of readiness and capacity could hinder the successful adoption of AI in secondary schools, preventing students from fully benefiting from these innovative technologies. Specifically, in Anambra State, there is a dearth of empirical evidence on the extent to which secondary school teachers are prepared to embrace AI in their classrooms. This study aims to investigate this problem and provide valuable insights for educational stakeholders.

Purpose of the Study

The purpose of the study was to ascertain secondary school teachers' readiness and capacity for AI adoption in Anambra State, Nigeria. Specifically, the study aimed to:

10. Assess secondary school teachers' awareness and preparedness for integrating AI tools in teaching.
11. Identify challenges and enablers of AI adoption in school systems.
12. Provide a framework for professional development programs in AI literacy

Research Questions

The study sought to answer the following research questions:

1. What is the level of awareness and perceived preparedness of secondary school teachers in Anambra State regarding the integration of Artificial Intelligence (AI) tools in their teaching practices?
2. What are the perceived challenges and enablers influencing the adoption of Artificial Intelligence (AI) within secondary school systems in Anambra State, as reported by secondary school teachers?
3. What are the key components and preferred modalities for a professional development framework in AI literacy, as suggested by secondary school teachers in Anambra State, to enhance their readiness and capacity for AI adoption?

Hypotheses

The study tested the following null hypotheses:

1. There is no significant relationship between teachers' awareness of AI and their readiness to adopt AI in secondary schools in Anambra State.
2. There is no significant relationship between teachers' access to AI tools and resources and their capacity to use AI in secondary schools in Anambra State.
3. There is no significant consensus among secondary school teachers in Anambra State regarding the key components and their preferred modalities of a professional development framework for AI literacy.

Theoretical and Practical Significance

Theoretical Significance:

This study will contribute to the existing body of knowledge on technology adoption in education, specifically in the context of AI. It will provide a theoretical framework for understanding the factors that influence teachers' readiness and capacity to adopt AI. The findings will also contribute to the ongoing discourse on the role of AI in transforming educational practices and improving student outcomes.

Practical Significance:

The findings of this study will have significant practical implications for various stakeholders in the education sector in Nigeria, particularly in Anambra State. The study will:

Provide empirical evidence to inform policy decisions related to AI integration in secondary schools; Offer insights to school administrators and educational planners on how to support teachers in adopting AI; Help teacher training institutions to develop programs that equip pre-service and in-service teachers with the necessary skills and competencies to use AI effectively; Identify the specific needs and challenges of teachers in adopting AI, enabling targeted interventions and support; Contribute to the development of strategies for enhancing teachers' readiness and capacity for AI adoption, leading to improved teaching and learning outcomes.

Methods

The study employed a descriptive survey research design. This design is considered appropriate for gathering data on teachers' perceptions, attitudes, and practices related to AI adoption in secondary schools (Creswell & Creswell, 2017). The study was conducted in Anambra State, Nigeria. Anambra State is located in the southeastern part of Nigeria and has a diverse educational landscape with varying levels of technological infrastructure and resources.

The population for the study comprised all secondary school teachers in Anambra State. The total number consisted 7027 teachers in 263 public secondary schools in the six educational zones of Anambra State obtained from the Anambra State Post Primary Schools Service Commission (PPSSC, 2024).

The study adopted multi-stage sampling technique. Stage one involved the use of Cochran's formula for sample size determination at 95% Confidence Interval, 5% Margin of Error, 50% Population Proportion, and 7027 population size to arrive at Sample Size of 365 teachers/respondents. Stage two involved using stratified sampling technique to stratify the population based on the 6 educational zones. Stage three involved using simple balloting without replacement method to select two (2) schools from each senatorial zone, which gave a total of twelve (12) Schools. Stage four involved the use of random sampling to select 365 teachers from the selected schools. This made up the sample size of 365 respondents

A structured questionnaire developed by the researchers titled "Teachers' Readiness and Capacity for AI Adoption Questionnaire (TRCAIAQ)." Was used to collect data from the teachers. The questionnaire was made into three clusters based on the three research questions that guided the study. Each cluster has 10 item, 4-Point Likert Scale to access the respondents' opinion of the subject matter.

The questionnaire was validated by three experts, two in educational technology, and one in measurement, and evaluation. Their feedback was used to ensure the clarity, relevance, and content validity of the instrument.

The reliability of the questionnaire was established using Cronbach's Alpha. A pilot study was conducted with a sample of teachers in selected secondary school in Ugwuoba in Enugu State to determine the internal consistency of the instrument. A reliability coefficient of 0.80 was obtained and therefore the instrument was considered acceptable.

The researchers obtained permission from concerned principals to administer the questionnaire in the selected schools. The questionnaires were administered to the teachers by the researchers and six briefed research assistants. The teachers were assured of the confidentiality of their responses. The data collected was analyzed using both descriptive and inferential statistics. Descriptive statistics, such as frequencies, percentages, means, and standard deviations, was used to answer the research questions. Inferential statistics, such as Pearson's correlation and t-tests, were used to test the hypotheses. The Statistical Package for the Social Sciences (SPSS) was used for data analysis.

Mean value of 2.5 and above was considered accepted or agreed, while any mean value below 2.5 was considered as rejected or disagreed. For testing the hypotheses, the significance level will be set at $p < 0.05$. If the p-value is less than 0.05, the null hypothesis will be rejected, and the alternative hypothesis will be accepted and vice versa.

Results

This section presented the findings of the study, organized according to the research questions and hypotheses. Tables and figures were used to present the data clearly and concisely.

Research Question One: What is the level of awareness and perceived preparedness of secondary school teachers in Anambra State regarding the integration of Artificial Intelligence (AI) tools in their teaching practices?

Table 1: Mean and standard deviation of responses on awareness and readiness for AI Awareness of AI in Education

Item	Awareness	Mean	Standard Deviation	Interpretation
i.	I am aware of what AI means in education	3.25	0.92	Majority of teachers have a basic conceptual understanding of AI.
ii.	I have used or encountered AI tools in teaching	2.45	1.03	Experience with AI tools is limited among most teachers.
iii.	I understand potential classroom applications of AI	2.84	0.95	Moderate understanding of AI's relevance to instruction.
iv.	I actively seek AI-related resources	2.46	0.97	Most teachers are passive in seeking AI-related knowledge.
v.	I believe AI can enhance student learning outcomes	3.22	0.88	Strong positive perception of AI's value in education.
Preparedness				
vi.	I am confident in integrating AI tools	2.50	0.97	Moderate confidence; a significant portion still unsure or unprepared.
vii.	I have received formal AI training	1.75	0.93	Majority lack formal training in AI integration.
viii.	I can adapt lesson plans to include AI	2.48	0.97	Mixed responses; some adaptability but not widespread.
ix.	My school supports AI integration	2.18	0.94	Institutional support is largely lacking.
x.	I feel prepared to assess AI tool effectiveness	2.22	0.95	Teachers feel underprepared to evaluate AI tool impact.

Summary

Awareness:

3. High conceptual awareness (~80% agree) of AI in education.
4. Low practical engagement with AI tools (only ~45% report actual use).
5. Positive belief in AI's potential, but passive learning behaviour
6. Perceived Preparedness for AI Integration

Preparedness:

6. Low overall preparedness, especially in terms of training and institutional support.
7. A gap exists between awareness and practical readiness for AI adoption.

General Findings

Awareness Levels:

Most teachers are aware of AI in education in a general sense and view it positively, but they lack in-depth or hands-on experience.

Preparedness Levels:

There is a significant deficit in training, school-level support, and self-efficacy regarding AI use. Only a minority feel ready to implement or evaluate AI tools in their classrooms.

Research Question Two: What are the perceived challenges and enablers influencing the adoption of Artificial Intelligence (AI) within secondary school systems in Anambra State, as reported by secondary school teachers?

Table 2: Mean and standard deviation on Perceived Challenges and Enablers for AI Adoption in Anambra State Secondary Schools

Perceived Challenges

Based on the teachers' responses, five key challenges were analyzed. A 4-point Likert scale was used (Strongly Agree = SA, Agree = A, Disagree = D, Strongly Disagree = SD). The following summarizes general trends:

Item	Perceived Challenges	Mean	Standard Deviation	Interpretation
xi.	.Lack of adequate training opportunities	3.42	0.80	High challenge: Majority agree training is lacking
xii.	Inadequate school infrastructure	3.46	0.79	High challenge: Infrastructure is a significant barrier
xiii.	Limited awareness among teachers	3.21	0.89	Moderate challenge: Awareness gaps exist
xiv.	Absence of AI-related policies	3.45	0.78	High challenge: Clear policy gap perceived
xv.	Fear of AI replacing teachers	2.95	1.00	Lower challenge: Fear exists but not dominant
Perceived Enablers for AI Adoption				
xvi.	AI professional development would boost confidence	3.34	0.83	Strong enabler: Training seen as valuable
xvii.	Leadership support is essential	3.42	0.81	Strong enabler: Leadership seen as key factor
xviii.	Peer collaboration is helpful	3.32	0.83	Positive enabler: Collaboration is beneficial
xix.	Access to AI tools boosts learning	3.38	0.79	Positive enabler: Tools seen as impactful
xx.	AI in curriculum prepares students for the workforce	3.44	0.80	Strong enabler: Curriculum integration supported

Key Insights:**Perceived Challenges**

- Over 85% of respondents agree there's a lack of adequate training and poor infrastructure, both major barriers.
- Policy absence is also a notable issue (88% SA + A).
- A moderate number of teachers expressed concern about AI replacing their roles (60% SA + A), highlighting psychological barriers.

Perceived Enablers

- vii. Teachers also identified potential facilitators for AI adoption in schools
- viii. Strong consensus (86–94%) supports the need for AI professional development.
- ix. Teachers emphasized collaboration, access to tools, and curriculum inclusion as critical motivators.
- x. Leadership support was also viewed as a strategic enabler.

Research Question 3: What are the key components and preferred modalities for a professional development framework in AI literacy, as suggested by secondary school teachers in Anambra State, to enhance their readiness and capacity for AI adoption?

Table 3: Mean and standard deviation on key components and preferred modalities for a professional development framework in AI literacy

Perceived Components of AI Professional Development

This section explores what teachers believe should be included in the framework to build AI literacy:

Item	Key components	Mean	Standard Deviation	Interpretation
xxi.	Understanding the basic concepts and functions of AI should be a core component.	3.33	0.84	Strongly supported: Core AI knowledge needed
xxii.	The framework should include hands-on training with AI tools relevant to classroom teaching.	3.35	0.83	Strongly supported: Practical AI training essential
xxiii.	Ethical implications and responsible use of AI in education must be addressed.	3.44	0.72	Strongly supported: Ethical considerations are crucial
xxiv.	Assessment and feedback mechanisms should be integrated into the training program.	3.24	0.83	Supported: Assessment mechanisms are important
xxv.	The program should be aligned with the national curriculum and education policies.	3.21	0.83	Supported: Curriculum alignment is necessary
Preferred modalities				
xxvi.	I prefer in-person workshops that provide direct interaction with facilitators and peers.	3.22	0.96	Supported but mixed: Preference for in-person interaction
xxvii.	Blended learning (combination of online and in-person formats) would be the most effective approach.	3.38	0.77	Strongly supported: Blended learning seen as ideal
xxviii.	Professional development should include peer mentoring or collaborative learning groups.	3.42	0.74	Strongly supported: Peer mentoring is valuable
xxix.	Online self-paced courses would be convenient and flexible for learning about AI.	3.29	0.85	Supported: Flexibility of online courses appreciated
xxx.	Training sessions should be scheduled during school breaks or holidays to ensure full participation.	3.38	0.75	Strongly supported: Scheduling during breaks seen as beneficial

Summary

Perceived Components:

Teachers in Anambra State believe that a robust AI literacy framework should:

- Build foundational knowledge of AI.
- Emphasize hands-on, practical training with classroom-relevant tools.
- Address ethical issues in AI integration.
- Include assessment tools to measure learning outcomes.
- Be aligned with the national curriculum and educational policies for contextual relevance.

Preferred Modalities:

Teachers prefer:

- Blended learning models (mix of online and in-person).
- Interactive, in-person workshops.
- Peer support structures like mentoring or group work.
- Scheduling that does not conflict with teaching responsibilities.
- Some openness to self-paced online modules, though not as strongly preferred.

Hypotheses Testing

This section provided a detailed report of the results of the statistical tests conducted to test each hypothesis. The findings were presented in relation to the stated hypotheses.

Hypothesis One Testing

Hypothesis Statement: There is no significant relationship between teachers' awareness of AI and their readiness to adopt AI in secondary schools in Anambra State.

Table 4: Pearson Correlation between AI Awareness and Readiness for Adoption

Variables	Awareness of AI	Readiness to Adopt AI	N
Awareness of AI	1	.486	365
Readiness to Adopt AI	.486	1	365

Note: $r = .486$, $p = .000$ (2-tailed).

Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation coefficient ($r = .486$) shows a moderate positive relationship between teachers' awareness of AI and their readiness to adopt AI in teaching. The p-value (.000) is less than the alpha level of 0.05, indicating that the relationship is statistically significant. This suggests that teachers with greater awareness of AI concepts and tools are more likely to express preparedness and willingness to implement AI in classroom settings.

Decision: Since the p-value is less than 0.05, the null hypothesis is rejected. Therefore, there is a significant relationship between teachers' awareness of AI and their readiness to adopt AI in secondary schools in Anambra State.

Hypothesis Two Testing

Hypothesis Statement:

There is no significant relationship between teachers' access to AI tools and resources and their capacity to use AI in secondary schools in Anambra State.

Table 5: Pearson Correlation between Access to AI Tools and Capacity to Use AI

Variables	Access to AI Tools	Capacity to Use AI	N
Access to AI Tools	1	.217	365
Capacity to Use AI	.217	1	365

Note: $r = .217$, $p = .000$ (2-tailed).

Correlation is significant at the 0.01 level (2-tailed).

The correlation coefficient ($r = .217$) indicates a weak positive relationship between access to AI tools and teachers' capacity to use AI. The associated p-value (.000) is less than the significance level of 0.05, indicating that the relationship is statistically significant. Thus, teachers who report higher levels of access to AI tools and resources also tend to report higher levels of perceived capacity to adopt and use AI technologies in their instructional practices.

Decision: Since the p-value is less than 0.05, the null hypothesis is rejected. This implies that there is a statistically significant relationship between teachers' access to AI tools and their capacity to use AI in secondary schools in Anambra State.

Hypothesis Three Testing

Hypothesis Statement: There is no significant consensus among secondary school teachers in Anambra State regarding the key components and their preferred modalities of a professional development framework for AI literacy.

Table 6: One-Sample t-test for Consensus on Components and Modalities

Category	N	Mean	t	df	Sig. (2-tailed)	Decision
Components (Items 21–25)	365	3.22	15.84	364	.000	Significant Consensus
Modalities (Items 26–30)	365	3.30	18.47	364	.000	Significant Consensus

The mean scores for both the components and modalities are significantly higher than the neutral value of 2.5. The p-values (.000) indicate that these results are statistically significant at the 0.05 level. This demonstrates that there is a strong consensus among secondary school teachers in Anambra State about the essential components and preferred formats for AI-related professional development.

Decision: The null hypothesis is rejected. There is significant consensus among secondary school teachers in Anambra State regarding both the key components and preferred modalities of a professional development framework for AI literacy

Discussions

Hypothesis One: There is no significant relationship between teachers' awareness of AI and their readiness to adopt AI in secondary schools in Anambra State.

The findings showed a moderate level of awareness and preparedness among teachers. While many understood the concept of AI and its relevance to education, few had hands-on experience or formal training. A Pearson correlation analysis revealed a statistically significant positive

relationship ($r = 0.486$, $p < 0.01$) between teachers' awareness and readiness. This indicates that increased awareness is positively linked to a higher readiness to adopt AI in classroom practices.

Hypothesis Two: There is no significant relationship between teachers' access to AI tools and resources and their capacity to use AI in secondary schools in Anambra State.

Teachers identified numerous barriers, including lack of infrastructure, limited training opportunities, and inadequate policy support. Nevertheless, access to AI tools and enablers such as leadership support and peer collaboration were perceived as capacity enhancers. The correlation analysis showed a significant positive relationship ($r = .217$, $p < 0.01$), suggesting that improving access to AI tools and resources can meaningfully enhance teachers' capacity to adopt and use AI.

Hypothesis Three: There is no significant consensus among secondary school teachers in Anambra State regarding the key components and their preferred modalities of a professional development framework for AI literacy. The t-test results indicated that teachers strongly agreed on the key components (mean values between 3.0 and 3.5) and preferred blended learning modalities. Items such as understanding AI concepts, hands-on training, ethical considerations, and alignment with curriculum were endorsed. There was a clear consensus that professional development should be conducted during school holidays and involve both online and peer-collaborative models. These findings reflect a unified demand for structured, flexible, and curriculum-aligned AI training.

Conclusion

The study concludes that teachers in Anambra State have a foundational awareness of AI and demonstrate readiness to adopt it in their professional practices. However, limitations such as inadequate training, poor infrastructure, and limited access to tools hinder effective AI integration. Teachers recognize the importance of well-designed professional development programs, expressing strong support for blended learning approaches and collaborative frameworks. Ultimately, the successful adoption of AI in secondary schools depends on targeted training, institutional support, and access to enabling resources.

Educational Implications of the Findings

1. Policy Formulation: The results highlight the need for national and state-level educational policies that prioritize AI literacy among teachers.
2. Curriculum Development: Teacher training curricula should integrate AI components to ensure pre-service and in-service teachers are adequately equipped.
3. Professional Development: Regular, structured, and flexible professional development programs should be instituted to build AI competence.
4. Infrastructure Investment: Schools must be equipped with the necessary digital tools and internet access to facilitate AI adoption.

Recommendations

1. Develop a national AI literacy framework for teacher education.
2. Provide regular blended learning-based AI training sessions for teachers.
3. Schedule professional development during school holidays.
4. Invest in digital infrastructure and AI tools for secondary schools.
5. Encourage peer mentoring and collaboration to sustain learning communities.

Limitations of the Study

1. The study focused solely on secondary schools in Anambra State, limiting generalizability.
2. It relied on self-reported data, which may be subject to bias.
3. The quantitative approach may not have captured deeper insights into teacher perceptions.

Suggestions for Further Studies

- i. Conduct comparative studies across multiple Nigerian states.
- ii. Explore AI adoption readiness among primary school teachers.
- iii. Use mixed-method approaches to capture richer data on teachers' experiences and attitudes.
- iv. Investigate long-term impacts of AI-focused professional development programs on teaching effectiveness.

Summary

This study assessed the readiness and capacity of secondary school teachers in Anambra State to adopt AI in education. Findings revealed a significant relationship between awareness and readiness, and between access and capacity. Teachers advocated for blended, collaborative, and curriculum-aligned professional development. While enthusiasm for AI is evident, infrastructure and policy gaps must be addressed to ensure successful integration. The study underscores the urgency of strategic planning in fostering AI literacy among educators to meet the demands of 21st-century education.

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EFFECT OF ARTIFICIAL INTELLIGENCE (AI) ON THE TEACHING OF ECONOMICS IN SENIOR SECONDARY SCHOOLS IN NIGERIA

¹Sheidu Kamoru Olanrewaju & ²Ubogu Cynthia Uche

^{1,2}Department of Arts and Social Sciences Education
Faculty of Education,
University of Lagos, Akoka, Yaba, Nigeria
osheidu@unilag.edu.ng

Abstract

The integration of Artificial Intelligence (AI) into education presents transformative potential, particularly in enhancing pedagogical practices and student learning outcomes. This study investigates the effect of AI on the teaching of Economics in Nigerian senior secondary schools, with a focus on how AI tools influence instructional delivery, facilitate personalized learning, and impact student academic performance. Anchored in a mixed-methods research design, the study engaged a sample of 250 respondents comprising Economics teachers and SS2 students from selected public and private secondary schools in Lagos State during the 2023/2024 academic session. Data were collected using structured questionnaires and interview guides to capture both quantitative trends and qualitative insights. The results revealed that AI significantly enhances teaching effectiveness by promoting interactive, student-centered learning environments and enabling data-driven instructional decisions. Students exposed to AI-based learning tools demonstrated increased engagement, improved comprehension of Economics concepts, and better academic performance compared to those taught using traditional methods. Despite these positive outcomes, the study identified several implementation challenges, including inadequate digital infrastructure, limited teacher capacity in AI integration, unequal access to technological tools, and resistance to change among some educators. These barriers contribute to disparities in AI adoption across school types and regions. The study underscores the urgent need for strategic policy interventions, particularly in expanding infrastructure, integrating AI into the national curriculum, and supporting continuous professional development for teachers. Additionally, it emphasizes the importance of designing affordable, context-specific AI solutions that are accessible to low-resource schools. This research contributes to the growing body of knowledge on educational technology adoption in Nigeria by offering subject-specific insights into AI's role in secondary education. It concludes that AI has a significant and positive effect on the teaching and learning of Economics, and can serve as a catalyst for educational transformation if supported by inclusive and sustainable implementation strategies.

Keywords: Artificial Intelligence, Academic Performance, Economics Teaching, Educational Technology, Instructional Delivery, Learning Outcomes, Senior Secondary Schools.

Introduction

The 21st century has ushered in a new era of teaching and learning, characterized by rapid technological advancements and digital integration in education. One of the most groundbreaking innovations in education is Artificial Intelligence (AI), AI in Education refers to the use of intelligent systems and algorithms to enhance instructional methods been increasingly deployed to personalize instruction, enhance student engagement, and facilitate administrative efficiency. It stands out as a transformative force, redefining how knowledge is delivered and absorbed. While developed countries have harnessed AI to transform classroom dynamics, its integration in developing nations is still emerging. In Nigeria, traditional method of teaching Economics at the

senior secondary level often face challenges such as teacher-centered pedagogy, large class sizes and limited instructional resources. The subject of Economics, central to understanding real-world decision-making and resource management, demands innovative teaching approaches to make it relevant, engaging, and practical. Integrating AI technologies into Economics Education has the potential to address these challenges by offering dynamic and interactive learning experiences fostering student autonomy and providing real-time feedback. AI-powered tools, such as intelligent tutoring systems, chatbots and predictive analytics, hold great promise for improving Economics instruction. This research explores the extent to which AI tools are currently being utilized, their impact on teaching effectiveness, student achievement and the practical barriers to their implementation. The study also delves into its functionalities to discover how AI affects the teaching of Economics in Nigerian senior secondary schools, highlighting its benefits, challenges, and implications for educators and policymakers.

Economics education is a core subject in Nigeria's secondary school curriculum, aimed at equipping and developing students with essential knowledge about economic principles, critical thinking, analytical, decision-making skills and financial literacy. However, traditional teacher-centered methods often dominate Economics classrooms in Nigeria, leading to disengagement and poor performance. The effectiveness of teaching this subject has been hampered by outdated teaching methods and a lack of resources. Globally, AI technologies – such as chatbots, virtual tutors, predictive analytics, and learning management systems – have revolutionized teaching, offering individualized instruction and automating repetitive tasks (Brynjolfsson & McAfee, 2014). Meanwhile, the Fourth Industrial Revolution is reshaping the global educational landscape with innovations like AI, which offers adaptive learning systems, immediate feedback mechanisms, and data-driven insights. Globally, countries like China, the United States, and Finland have already integrated AI into classrooms, reporting enhanced learning experiences and better student outcomes (Holmes et al., 2019). In Nigeria, there is a growing recognition of the need to align education with emerging technologies. Nonetheless, however, AI adoption is limited by infrastructural deficits, lack of technical expertise, and resistance to change. In Education, empirical research on the effectiveness of AI in secondary school Economic Education is still sparse. This study addresses this gap by investigating how AI can transform Economics teaching practices in Nigerian senior secondary schools. As such, there is a pressing need to evaluate how AI tools can be harnessed effectively to improve the teaching of Economics at the secondary level in Nigeria.

Statement of the Problem

Despite the global proliferation of AI in education to improve educational outcomes, its adoption and implementation in Nigerian secondary schools remains minimal, uneven and poorly understood. While some private schools in the urban areas have begun the integration of digital tools into instruction, public schools, particularly in rural areas, often lack the necessary infrastructure and training. Traditional instructional approaches, characterized by rote memorization and large class sizes, continue to dominate Economics classrooms. This stagnation in pedagogical practice contributes to poor academic performance, limited critical thinking, and a disconnect between Economics content and real-life applications. While AI presents a promising solution, there is insufficient empirical data on its actual impact on the teaching of Economics in Nigeria. Without a clear understanding of AI's effectiveness and the barriers to its adoption, educators and policymakers cannot make informed decisions. This study, therefore, seeks to investigate the extent to which AI affects Economics instruction and what challenges must be addressed for its successful integration.

Objectives of the Study

The main objective of this study is to examine the impact of Artificial Intelligence on the teaching of Economics in senior secondary schools in Nigeria. The specific objectives are to:

1. assess the extent of AI integration in the teaching of Economics;
2. determine the effect of AI tools on teaching effectiveness;
3. examine the influence of AI on students' academic performance;
4. identify the challenges hindering AI adoption in Economics classrooms; and
5. recommend strategies for effective AI implementation in Economics education.

Research Questions

1. To what extent are AI tools integrated into Economics teaching in Nigerian secondary schools?
2. How does AI impact the effectiveness of Economics teachers?
3. What is the relationship between AI use and student academic performance in Economics?
4. What challenges hinder AI adoption in Economics education?
5. What strategies can enhance the effective use of AI in teaching Economics?

Research Hypotheses

H01: There is no significant relationship between AI integration and teaching effectiveness in Economics.

H02: There is no significant difference in academic performance between students taught with AI tools and those taught using traditional methods.

Scope and Limitations of the Study

This study primarily investigates the impact of Artificial Intelligence (AI) on the teaching of Economics in senior secondary schools in Nigeria, with specific focus on SS2 students during the 2023/2024 academic session. The geographical scope is limited to selected public and private senior secondary schools within Lagos State, Nigeria. The choice of Lagos State is informed by its status as a major educational, technological, and economic hub, where AI adoption is relatively more visible compared to other regions of the country. The study examines AI-driven instructional tools such as intelligent tutoring systems, adaptive learning platforms, AI-enabled assessment applications, and virtual assistants as they relate to the teaching and learning process in Economics. The focus is specifically on AI-based technologies; traditional digital tools (such as projectors, PowerPoint slides, or internet browsing for general research) that do not possess AI functionalities are excluded from this study. The study considers teacher and student perceptions, instructional practices, access to AI tools, and their effects on student engagement and academic outcomes in Economics. However, several limitations are acknowledged.

The study is confined to Lagos State and does not include other states or geopolitical zones in Nigeria. Consequently, findings may not be generalizable to the national context due to regional disparities in infrastructure, policy implementation, and access to technology. There is unequal access to AI tools and digital infrastructure among schools, especially between public and private institutions. This digital divide may influence the consistency and comparability of data across sampled schools. The research only addresses AI-enabled educational technologies used in the teaching of Economics. It does not account for the broader impact of AI on other subjects or general school administration processes. The study faced limitations in time, funding, and personnel, which restricted broader data collection across more schools or inclusion of longitudinal performance tracking. Teachers' varying levels of digital literacy and lack of formal

training in AI applications may affect the quality and depth of AI integration in teaching, which could influence the results.

Significance of the Study

This research is of utmost importance, benefiting teachers by providing insights on modern instructional strategies and also crucially important to students through improved learning outcomes. The study is absolutely essential to Policy Makers in forming inclusive technology policies and paramount to researchers by filling gaps in the literature on AI in Economics education in Nigeria.

Furthermore, it lays a strong foundation for future innovation in curriculum design, ensuring that educational practices remain relevant and responsive to the evolving demands of the digital age.

Literature Review

Conceptual Review

Artificial Intelligence in Education refers to the use of intelligent systems that can simulate human learning behavior. It includes: **Intelligent Tutoring Systems, (ITS)**- It provides customized feedback and adaptive learning paths, **Virtual Class Assistants**-It gives answers to student questions assisting them with administrative tasks and **Learning Analytics** - It is a form of learning system that uses student data to predict performance and suggest interventions (Holmes et al., 2019).

Economics Education: Teaching Economics involves analytical and logical reasoning. Traditional lecture methods are often rigid and ineffective for today's learners. AI introduces interactive simulations and personalized feedback, enhancing student comprehension and engagement.

Theoretical Framework

The theoretical foundation of this study is anchored on **Constructivist Theory** by *Lev Vygotsky (1978)* and the **Technology Acceptance Model (TAM)** by *Fred Davis (1989)*. These two theories jointly provide the intellectual basis for understanding how Artificial Intelligence (AI) can influence the teaching and learning of Economics in senior secondary schools in Nigeria.

Constructivist Theory (Vygotsky, 1978)

The Constructivist Theory posits that learning is an active, contextualized process where learners construct knowledge through experience and interaction with their environment. Vygotsky emphasized the role of **social interaction** and **collaborative engagement** in learning, arguing that cognitive development is shaped through social mediation and scaffolding provided by teachers or peers. Within this framework, students are not passive recipients of information; rather, they actively build understanding through exploration, dialogue, and problem-solving activities.

In the context of **AI-assisted teaching of Economics**, constructivism underscores the potential of adaptive learning platforms, virtual simulations, and interactive learning analytics to promote student-centered instruction. Artificial Intelligence tools such as intelligent tutoring systems, chatbots, and game-based simulations enable learners to engage dynamically with economic concepts like *demand and supply*, *market equilibrium*, and *fiscal policy* through real-time feedback and individualized content. These systems function as “virtual scaffolds” that guide learners through progressively challenging tasks, consistent with Vygotsky’s **Zone of Proximal**

Development (ZPD), where AI acts as the “more knowledgeable other” facilitating conceptual mastery.

Furthermore, the constructivist approach aligns with modern **digital pedagogy**, which encourages experiential learning through AI-driven visualization and modeling tools. By personalizing instruction and promoting inquiry-based engagement, AI tools enhance students’ cognitive participation and motivation in Economics, making abstract economic principles more relatable and applicable to real-world contexts.

Technology Acceptance Model (Davis, 1989)

The **Technology Acceptance Model (TAM)** provides an explanatory framework for understanding how individuals adopt and utilize technology in educational settings. According to Davis (1989), two primary determinants **perceived usefulness (PU)** and **perceived ease of use (PEOU)** influence users’ attitudes and behavioral intentions toward technology adoption. When applied to AI integration in Economics education, TAM suggests that teachers and students are more likely to embrace AI tools if they believe these technologies will enhance teaching efficiency, improve learning outcomes, and simplify instructional processes.

For teachers, AI’s perceived usefulness may manifest through automated grading systems, predictive analytics for student performance, and intelligent lesson planning, all of which reduce workload and promote instructional precision. For students, AI’s perceived ease of use translates into intuitive learning environments that adapt to their pace and learning preferences, promoting engagement and comprehension. The TAM framework thus highlights the importance of **teacher competence, technological literacy, and institutional support** in facilitating effective AI implementation in Economics classrooms.

When both theories are integrated, they present a comprehensive understanding of the AI learning nexus: while constructivism explains the **pedagogical process of knowledge construction**, TAM elucidates the **behavioral and psychological dimensions** influencing AI adoption by both educators and learners. This dual theoretical foundation underscores that the success of AI in Economics education depends not only on the technology’s capabilities but also on the users’ acceptance and meaningful interaction with it.

Empirical Review

Empirical evidence from existing studies substantiates the theoretical assumptions of this research. A growing body of literature demonstrates that Artificial Intelligence significantly transforms the teaching and learning landscape by promoting engagement, personalization, and efficiency in the classroom.

Okonkwo and Ogbaji (2021) investigated the impact of AI-driven instructional tools on student engagement in Economics and found that AI applications, such as intelligent tutoring systems and adaptive simulations, enhanced students’ participation, curiosity, and conceptual understanding. Their findings align with Vygotsky’s constructivist premise that active engagement leads to deeper learning, suggesting that AI-supported interactive experiences can promote students’ higher-order thinking skills.

Similarly, **Adebayo and Eze (2022)** reported that students exposed to AI-based teaching methodologies outperformed their peers in standardized Economics assessments. The study attributed these gains to AI’s capacity to individualize instruction, provide instant feedback, and

accommodate different learning speeds key elements of effective constructivist learning environments. Their findings affirm the pedagogical potential of AI in fostering mastery learning and improved academic achievement.

However, **Uche and Olatunji (2023)** identified infrastructural inadequacies, limited teacher training, and low digital literacy as major constraints to AI adoption in Nigerian public secondary schools. These findings resonate with the Technology Acceptance Model, particularly the constructs of perceived ease of use and perceived usefulness, indicating that without adequate infrastructure and professional development, the adoption of AI technologies may remain limited, regardless of their pedagogical potential.

Furthermore, empirical evidence supports the application of AI tools such as **adaptive learning systems, virtual tutors, automated assessments, and learning analytics** in educational contexts. These innovations adjust learning content according to students' individual abilities, track progress, and recommend tailored interventions thereby promoting engagement, self-efficacy, and conceptual mastery. In Economics, AI-based **simulation and game-based platforms** have been shown to effectively demonstrate complex concepts like *inflation, market dynamics, and taxation*, making abstract ideas tangible through visualization and experimentation.

Collectively, these empirical studies reinforce the theoretical assumptions of Vygotsky (1978) and Davis (1989), confirming that AI facilitates interactive, adaptive, and user-accepted learning environments. Nevertheless, challenges such as inadequate digital infrastructure, resistance to innovation, and insufficient teacher training continue to moderate the effectiveness of AI integration in Nigerian secondary schools.

Synthesis of Theoretical and Empirical Frameworks

The integration of constructivist and technological acceptance perspectives suggests that the **effectiveness of AI in the teaching of Economics** is contingent upon both pedagogical and technological dimensions. Constructivism emphasizes the **learning process**, focusing on how AI tools enhance engagement, interaction, and knowledge construction, while TAM focuses on the **adoption process**, determining how teachers and students perceive and accept the technology. Empirical findings across Nigerian contexts validate these relationships, indicating that successful AI implementation requires both **cognitive engagement** (constructivist principle) and **positive technology perception** (TAM principle).

Therefore, this study builds on the combined insights of theory and evidence to assess the **effect of Artificial Intelligence on the teaching of Economics in senior secondary schools in Nigeria**, emphasizing both the pedagogical implications and the contextual constraints affecting its practical application.

Gaps in the Existing Literature

While global research has widely affirmed the transformative potential of Artificial Intelligence (AI) in education particularly in enhancing personalized learning, automating assessments, and improving student engagement there remains a significant gap in context-specific, subject-focused studies within the Nigerian educational system. Most existing studies in Nigeria tend to approach AI adoption from a general pedagogical or administrative perspective, often overlooking its specific influence on individual subjects like Economics.

Furthermore, local studies that do reference AI in Nigerian classrooms frequently adopt a theoretical or conceptual lens, with minimal empirical validation from real classroom environments. Additionally, such studies rarely evaluate how teachers integrate AI tools into daily instructional practices or how these tools affect student understanding, motivation, and academic performance in specific disciplines. Another notable gap is the underrepresentation of secondary school perspectives, particularly at the senior secondary level where Economics is a core subject influencing career pathways in commerce, social sciences, and national economic literacy. Most AI-related educational research in Nigeria is concentrated in higher institutions, leaving secondary education especially the senior secondary segment largely underexplored.

Moreover, existing literature often lacks comparative analysis between AI-integrated and traditional teaching methods in Economics classrooms. Lastly, few studies investigate the challenges and limitations teachers face when integrating AI in classroom settings, such as resistance to technology, inadequate training, lack of infrastructure, or curriculum rigidity. These overlooked practical realities hinder a full understanding of AI's feasibility and sustainability in Nigerian secondary schools. This study seeks to bridge these gaps by providing empirical evidence on the actual use, benefits, and challenges of AI applications in the teaching of Economics in senior secondary schools in Nigeria, thereby contributing to a more nuanced and actionable body of knowledge.

Research Methodology

The study adopts a mixed-methods design, combining descriptive survey and case study approaches to collect quantitative and qualitative data. The target population includes all SS2 Economics teachers and students in selected Lagos State secondary schools with an estimated total population of 2,000 participants. Using stratified random sampling, the study selects a sample of 250 respondents (200 students and 50 teachers) across 10 schools (5 public schools, 5 private schools). Schools were categorized into urban/rural schools, public/private schools.

Stratified random sampling was used to ensure balanced representation across school types and geographical areas. A well detailed, comprehensive and structured questionnaire containing: closed and open-ended questions was used to gather information from students and teachers, also a semi-structured interview guide was used to collect detailed responses from selected teachers and ICT staff (coordinators). Instruments were reviewed and validated by three experts in Educational Technology. A pilot study was conducted in two schools. Cronbach Alpha reliability coefficient was 0.81, indicating high level of consistency. Consent letters were sent to school administrators. Also, questionnaires were distributed physically and digitally. Interviews were recorded and transcribed for analysis. Quantitative data analysis used - SPSS (descriptive statistics, Pearson correlation, t-tests), while Qualitative data analysis used thematic coding.

Ethical Considerations

This study adheres strictly to ethical standards in educational research to protect the rights, dignity, and welfare of all participants involved. Informed consent was obtained from all participants, including teachers and students, prior to data collection. For students under the age of 18, parental or guardian consent was also secured through the school authorities to ensure compliance with ethical requirements concerning minors. Participants were fully briefed about the purpose, procedures, and expected outcomes of the research. It was clearly communicated that participation was entirely voluntary, and respondents could withdraw from the study at any point without any penalties or consequences. There was no coercion, inducement, or pressure applied in the recruitment process.

Anonymity and confidentiality were strictly maintained throughout the study. All personal identifiers, including names, school affiliations, or contact details, were removed or coded to protect individual identities. Responses were reported in aggregate form only, and access to raw data was restricted to the core research team. Data were stored securely in password-protected electronic files and will be deleted after the research project concludes, in accordance with data protection policies. To minimize potential harm or discomfort, all survey instruments and interview questions were reviewed to ensure that they were non-intrusive, age-appropriate, and culturally sensitive. Participants were assured that their responses would be used solely for academic and research purposes, and no information would be shared with third parties or used for commercial gain.

Moreover, the study received approval from the relevant educational authorities and institutional review boards, including the Lagos State Ministry of Education and school management boards. All procedures aligned with ethical guidelines outlined by the Nigerian Educational Research and Development Council (NERDC) and international ethical standards in human subject research. Special consideration was also given to the power dynamics between teachers and students to avoid undue influence. Teachers were advised not to be present during students' responses to minimize bias or pressure. Additionally, the use of digital tools during the research adhered to principles of digital ethics, including responsible AI usage and data privacy protections. By upholding these ethical principles, the study ensures credibility, transparency, and integrity in its findings, while safeguarding the welfare of all participants involved.

Data Presentation, Analysis and Results

This section presents the data collected from the field and the subsequent analysis undertaken to examine the **effect of Artificial Intelligence (AI) on the teaching of Economics in senior secondary schools in Nigeria**. The analysis is structured to provide a comprehensive understanding of the respondents' demographic characteristics as well as their responses to the research variables under investigation. Data were analyzed using **descriptive and inferential statistical techniques**, which include frequencies, percentages, mean scores, standard deviations, and where necessary, correlation and regression analyses to test formulated hypotheses.

The descriptive statistics were employed to summarize and interpret the data in an organized form, thereby facilitating a clearer understanding of respondents' distribution across relevant demographic variables. These demographic characteristics such as gender, school type, and teaching experience are essential for contextualizing the study, as they help in identifying patterns that may influence teachers' and students' perceptions and utilization of AI in Economics education. The demographic information further provides a foundation for assessing the representativeness and reliability of the responses gathered from both teachers and students.

The inclusion of demographic variables such as **gender and teaching experience** among teachers and **school type** among students is critical to understanding the dynamics of AI adoption in Nigerian educational settings. Gender distribution offers insights into the inclusivity and participation levels of both male and female teachers and students in technology-mediated learning environments. Similarly, variations in teaching experience help determine how exposure to educational technology correlates with teachers' competence, adaptability, and willingness to integrate AI tools into classroom instruction. Moreover, comparing responses across **public and private school settings** reveals potential disparities in access to digital resources, infrastructure, and institutional support systems. The subsequent tables are therefore presented to illustrate the demographic structure and the general trends in the respondents' perceptions of AI-based teaching

and learning of Economics. The results are displayed using **frequency distributions, percentages, mean scores, and standard deviations**, which collectively enhance the interpretability of the data and provide a robust statistical foundation for addressing the research questions and hypotheses of the study. Tables presented demographic information, mean scores, standard deviations, and frequency distributions.

Table 1: Demographic Information of Respondents

Variable	Category	Frequency (n)	Percentage (%)
Gender (Teachers)	Male	30	60%
	Female	20	40%
Gender (Students)	Male	120	60%
	Female	80	40%
School Type	Public	130	52%
	Private	120	48%
Teaching Experience	1–5 years	10	20%
	6–10 years	25	50%
	Above 10 years	15	30%

The demographic distribution reveals a balanced representation across gender and school types, with a majority of teachers having 6–10 years of experience, indicating a well-informed respondent base capable of providing credible insights on the impact of AI in Economics education.

Table 2: Mean and Standard Deviation of AI Usage and Teaching Effectiveness

Item	N	Mean ($\bar{x}$)	Std. Deviation (SD)	Interpretation
Level of AI integration in teaching	50	3.08	0.74	Moderate use
AI effectiveness in supporting lesson delivery	50	4.11	0.56	High impact
Improvement in student engagement through AI	200	4.02	0.63	High impact
Student understanding of Economics concepts enhanced by AI	200	4.15	0.52	High impact
Accessibility of AI tools in schools	50	2.89	0.68	Moderate availability
Teachers' confidence in using AI	50	3.31	0.71	Moderate

This result indicates a generally high perceived impact of AI on teaching effectiveness and student learning, though moderate levels of AI integration, accessibility, and teacher confidence suggest the need for enhanced support and infrastructure to maximize its educational potential.

Table 3: Frequency Distribution of Students' Academic Performance (AI Group vs. Non-AI Group)

Score Range (%)	Frequency (AI Group)	Percentage (%)	Frequency (Non-AI Group)	Percentage (%)
70–100	85	42.5%	48	24%
60–69	65	32.5%	60	30%
50–59	35	17.5%	52	26%
Below 50	15	7.5%	40	20%
Total	200	100%	200	100%

The data above shows that students exposed to AI-based learning significantly outperformed their non-AI counterparts, with a higher concentration in the 70–100% score range and fewer students scoring below 50%, indicating the positive impact of AI on academic achievement.

Analysis Based on Research Questions

The analysis found based on the research questions indicates **moderate use of AI tools**. The **mean score for level of AI integration** is **3.08** (SD = 0.74), indicating **moderate usage**. Access to AI tools remains a constraint (mean = 2.89). It also shows **positive effect on teaching effectiveness** as teachers reported a **high positive effect** of AI on **lesson delivery** (mean = 4.11) and **teaching confidence** (mean = 3.31). Teachers felt AI improved feedback speed, visual explanation of concepts, and adaptive pacing of instruction. It further presents that students' use of AI-assisted methods showed **greater performance in understanding and scores, improving students' academic outcomes**. 42.5% scored 70–100 (vs. 24% in non-AI group), only 7.5% scored below 50 (vs. 20% in non-AI group). AI facilitated **interactive simulations, chatbot explanations, and automated quizzes** that reinforced learning.

Furthermore, AI closes **significant academic performance gaps**. T-test and mean differences suggest that students in **AI-integrated classrooms significantly outperformed** their counterparts ($p < 0.05$). Findings showed that AI tools are moderately used but significantly, it improves teaching effectiveness and student understanding of Economics concepts.

Testing of Hypotheses

A t-test showed significant difference in student performance between AI-assisted and traditional classrooms ($p < 0.05$). Pearson correlation confirmed a positive relationship between AI use and teaching effectiveness.

Findings align with existing literature (e.g., Holmes et al., 2019), confirming that AI improves both teaching and learning outcomes. However, infrastructural limitations remain a challenge in rural schools. AI tools enhance engagement, participation, and understanding. Students taught with AI perform better in Economics tests. Major challenges include poor internet, lack of teacher training, and cost barriers.

Conclusion and Recommendations

The study examined the influence of AI on teaching Economics in Nigerian secondary schools. It employed a mixed-method approach and found that AI positively affects both teaching practices and student performance, despite systemic challenges. AI holds immense potential to transform Economics education. However, its benefits can only be fully realized through strategic investments in infrastructure, policy support, and teacher training.

The findings of the study underscore that while AI integration in the teaching of Economics offers innovative, personalized, and engaging learning experiences, its impact is unevenly distributed due to infrastructural disparities, limited teacher readiness, and lack of curriculum alignment. Addressing these systemic barriers is essential to achieving equitable and sustainable AI integration in Nigerian secondary education.

It is therefore recommended that the Nigerian Educational Research and Development Council (NERDC) should review and update the senior secondary Economics curriculum to incorporate AI-enabled teaching methodologies and digital competencies. This alignment will ensure AI tools are not just supplementary but embedded within formal teaching practices. Educational stakeholders, including the Ministry of Education and school management boards, should establish robust monitoring and evaluation mechanisms to assess the effectiveness, equity, and ethical use of AI tools in classrooms. This will enable data-driven improvements and accountability in AI integration efforts. Government should also provide funding and policies to support AI in education, schools should invest in infrastructure and professional development, teachers should embrace continuous learning on educational technologies, EdTech Companies should design affordable AI solutions for low-resource schools.

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CODE - MIXING AND CODE - SWITCHING: STYLE OF LANGUAGE USE AMONG IGBO GOSPEL ARTISTS

Ugwu, Ifunanya Gertrude (Mrs), Enu Evelyn Nwene (Ph.D),
Babalola, Joseph Oladipupo (Mr) &
Osuala Emmanuel Mmaduabuchukwu (Mr.)

*Linguistics Department
Faculty of Arts*

^{1,3,4}University of Ilesa, Ilesa, Osun State

²Emmanuel Alayande University of Education,
Oyo, Oyo State
ugwuifygert@gmail.com

Abstract

Songwriting is the art of composing words and music, adding lyrics to it in order to fit the melody. This whole thing words and music have to convey a uniform tone and mood. Recently there is a new trend among Igbo Gospel Artists in gospel music. The trend is a mixture or combination of Igbo and English languages in their gospel Music. This paper therefore aims at identifying features of Code mixing and Code Switching (Igbo / English) in some Igbo gospel Music. It will also highlight its consequences on Igbo Language and proffer some possible solutions to save the use of Igbo language from being adulterated. The relevance of AI to code-mixing and code-switching will be mentioned.

Keywords: Code-mixing, Code Switching, Igbo, Gospel Artist, AI, Music

Introduction

Music is sounds that are arranged in a way that is pleasant or exciting to listen to. e.g Pop, dance, classical, church music. Hornby,(2000) People sing music or play it on instruments. Some terms are important in this paper. They are Code, Mixing, Switching, Code - Mixing and Code - Switching. Hornby (2000) defined, code, mixing and switching in the following ways: Code is a system of words, letters, and numbers or symbol that represent a message or record information secretly or in a shorter form. Mixing means putting two or more things together.

Switching means a change from one thing to another especially when the change is sudden and complete. Hymes (1974) defined Code - Switching as "a common term for alternative use of two or more languages, varieties of a language or even speech styles"

Bokamba (1989) defined both concepts thus:

"Code - switching is the mixing of words, phrases and sentences from two distinct grammatical systems across sentence boundaries within the same speech event". "Code mixing is the embedding of various linguistic units such as affixes (bound morphemes), words (unbound morphemes) phrases and clauses from a co-operative activity where the participants in order to infer what is intended, must reconcile what they hear with what they understand". Mathews (1997) defined Code-mixing as a situation where a speaker switches at frequent intervals from one language to another for no discoverable external reason.

He also defined Code - Switching as switching in speech between different languages or dialects. Sometimes the two terms are used interchangeably by language scholars.

Functions of Music

According to Adegoke (1999) music is known to play a vital part in the life of people from cradle to grave. Music still plays a major part in the life of an African infant. His/ Her birth is heralded with singing and dancing. Music plays two major roles in children's game:

1. The rhythm helps co-ordination of action and movement, and singing or clapping calls for the participation of all in some form of activity throughout the duration of the game.
2. Its calls for the participation of audience thus helping to keep the interest and attention of children to whom the story is primarily aimed.

Music is helpful when a group of people work together.

It acts as a distraction from the burden of the work and also it contributes to the coordination of energy in unified team work in that action is tied up with the rhythm of the song, be it paddling a canoe, cutting grass, tugging at ropes e.t.c.

Music still plays a major part at funerals (whether it is wake keeping, the rites of interment, and the mourning period e.t.c.)

Music can be used as a recorder of history. Music features in Ballads, Legends, Myths and historical accounts and information concerning many African people are stored and retrieved in songs and dances.

Music is used for passing information, for castigating those in authority, for condemning evil and for praising noble actions. Music serves as a means of unity between towns and nations. Music is also a source of getting money or making wealth.

Music is used for both traditional and religious worship. All forms of worship make use of Music. The Christians, Moslems, and traditional religion and all forms of religion have elements of music in their mode of worship and festivals.

Music is used for entertainment: Music is used for entertainment. Entertainment is seen as an act of arousing the interest of an individual, groups, or community through jokes, music, or drama in order to please the person's heart, thereby raising him to a high level of ecstasy. Music creates a lasting impression and a platform to express their people's sentiments.

Music performs panegyric function: Music, according to Vidal (1987), is 'the institution of praise-chanting and praise-singing is firmly established especially where someone, through it, has an important core of music. greatness, individuals become proud of their genealogy while children are motivated to live up to the qualities of their ancestors'. Music serves as a veritable tool in ascribing praises and showering encomiums on distinguished members of the society. During occasions where music is performed, the musicians play to welcome important dignitaries. The musicians play to praise and exalt the guest. The contributions of each individual to the society are mentioned and the audience also is thrilled and corroborates such praise by shouting and hailing the person that is eulogized. Sometimes the eulogized individuals wave their hand or in turn spray the musicians with money to express their appreciations.

Features of Code-Mixing and Code-Switching.

Five Igbo gospel artists and three Igbo albums were selected for this paper. Every effort to reach them to get approval to use their albums proved abortive. Two artists were reached and they gave written approval to use their albums. Evidence is attached at reference section. This led to making use of two artists and one album each.

- i. Five tracks (5) from Amaka Okwuoha (aka Chioma Jesus) album "Chioma Jesus" were also selected out of ten tracks. The tracks are one, two, seven, eight, and ten. The tracks were selected because they have features of code-mixing and code-switching.
- ii. Five (5) tracks from Rev. (Dr.) David Nebife's album "24 Elders Worship" were selected out of twenty-five (25) tracks. The tracks are one, two, three, four and five. Similarly, these tracks were selected because they have features of code-mixing and code-switching from English to Igbo and vice-versa.

Data I

Artist: Amaka Okwuoha (aka Chioma Jesus)

Album Title: Chioma Jesus

Track I: Ihem ga-abu – What I will be

Style of music: code mixing (Igbo and English)

Chorus:

(Aga m abu ihe chineke)	→	I will be what God said)	
si na m gabu e	→	I will be	
Aga m abu, olu aka mmadu	→	I will be, man	
agaghi egbochi ya.	→	Cannot stop it (2times)	2X
Chi mu e	→	My God e	
Chorus	→	Chorus	2X

Onye ga – egbochi ya e	→	who can stop it e
Onye? olu aka mmadu	→	who? man
Apughi igbochi ya.	→	cannot stop it
Onweghi onye obu e	→	nobody
Aga m abu, olu aka mmadu	→	I will be, man
apughi ighochi ya.	→	cannot stop it.
Olu aka mmadu	→	work of man

apughi igbochi ya e (2x)	→	cannot stop it e (2x)
Olu aka ekwensu	→	satan, cannot
agaghi egbochi ya	→	stop it
ogwu agworo agwo	→	charm
agaghi egbochi ya	→	cannot stop it
ma oli, ma oli	→	at all, at all
Atumatu mmedu	→	man's plan
agaghi egbochi ya	→	cannot stop it
Witches and Wizards	→	witches and wizards
Apughi igboghi ya	→	cannot stop it
Native Doctor apughi	→	native Doctor
Igbochi ya	→	cannot stop it

Track 2– O Disappointghi m

Chorus

O disappointghi muo –
Kamgbe m ji were ya wee mere
Chi mu o
O disappointghi mu o

2x

Jesus onye na-ekwe nkwa mee ya

Chorus:

Jesus onye na – aza m ekpere o

Chorus:

Jesus onye na – ekwe nkwa mee ya

Chorus:

Nkwa nile o kwere, o meworo m ya

Chorus:

Kamgbe m ji were ya wee mere daddy

Chorus

Kamgbe m na - eso ya, esosi ya ike.

Chorus

Nne ga agharipu gi
Ma Jesus agaghi agharipu gi

Chorus:

Ikwu na ibe ga- agharipu gi
Ma Jesus agaghi agharipu gi o

Chorus:

Ewo chi m oma
Elu uwa ga echefu gi
Ma Jesus agaghi echefi gi o

Chorus (2x)

Track 7: Gi ka m na –akpo

Style of Music: Code Switching

Chorus: (Jehovah Okwa gi ka m na-akpo) 1x

Jehovah Jireh lee
Onye m ji eme onu ewo!
O kwa gi ka m so na-azu
Igbe na-eche ndu mu o
O kwa gi ka m kwo aba
Onye na-enye m ndu lee

He has never disappointed me

Chorus

He has never disappointed me
Since I have taken Him
to be my God
He has not disappointed me

2x

Jesus, promise keeper

Chorus:

Jesus that answers my prayers

Chorus:

Jesus, promise keeper

Chorus:

He has fulfilled all His promises

Chorus:

Since I take Him as my Daddy

Chorus

Since I have been following Him

Chorus

Mother can disappoint you
But Jesus will not disappoint you

Chorus:

Relatives may disappoint you
But Jesus will not disappoint you

Chorus:

Ah! my good God
The world will forget you
But Jesus will not forget you

Chorus (2x)

You are the one am calling

Chorus: Jehovah Is you that I am calling

Jehovah Jireh lee
I am boosting in you
You are my mentor
Keeper of life
I am proud of you
Giver of life

O kwa gi ka m so na-azu
Nwanne otu onye

Chorus

Onye na-edu m ije

Chorus

O nweghi onye ozo nwere

Chorus

mgbe m na-agu egwu lee

Chorus

mgbe m na-aruru

Chorus

mgbe m na-ehi ura

Chorus

mgbe ibu uwa na-anyigbu m

Chorus

mgbe ekwensu na agbo uja

Chorus

mgbe ewuwa na-ebu m agha

Chorus

- - - -
- - - -
- - - -

Switched To English

Call me in the time of trouble
I will deliver you
and you shall give my name glory

Interlude: Otu a ka i kwuru (This is what you said)

Jehovah you said you will visit me
for the appointed time to visit Zion
The time has come
You said you will neither leave
nor neither forsake me
Oh! Jehovah you are my God
Never put me to shame
They that wait upon the Lord
They shall renew their strength

Back to Igbo

Ana m akpo gi chi m

You are my mentor
Brother to the brotherless

Chorus

My guardian

Chorus

I have no other person

Chorus

When I am singing

Chorus

When I am working

Chorus

When I am sleeping

Chorus

When burdened

Chorus

When satan is making me afraid

Chorus

When the world is fighting me

Chorus

- - - - -
- - - - -
- - - - -

—————>
—————>
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Back to Igbo

I call you my God

Agbawala m aka
Nye m di, di nke aka m
Nye m nwa
Nye m oru
o bu ya ka m ji akpo gi Jehovah

Do not leave me empty handed
Give me my own husband
Give me my own children
Give me work
This is why I call you Jehovah

Chorus (3x)

Chorus (3x)

Track 8: Mighty Jehovah

Style of Music: Code Switching

Chorus

{	You are so good	}	4x	_____>
	You are so kind			_____>
	Mighty Jehovah, Mighty Redeemer			_____>
	You are so good			_____>
	I am that I am			_____>

Chorus

Ancient of days

_____>
_____>
_____>

Chorus

Jehovah Jireh

_____>
_____>
_____>

Chorus

You have never failed me
You have never disappointed me
Oh Jehovah I worship you
Ancient of days
There is no one like you
Your mercy remain forever

_____>
_____>
_____>
_____>
_____>
_____>

Chorus

There is no one like you
You are so miraculous
You are so excellent

_____>
_____>
_____>

Chorus

Jehovah Jireh
Jehovah Nissi
Jehovah Elohim

_____>
_____>
_____>
_____>
_____>

Chorus

Switched to Igbo version

I diri m mma na-ezie _____>
Onye m ji eme onu _____>
I diri m mma na-ezie _____>
Echeta obi esie ike. _____>
- - - -

You are really good to me
I am proud of you
You are really good to me
When I remember you I am strong
- - - -

- - - -
- - - -
Mighty Jehovah
Mighty Redeemer
Chorus (3x)

- - - -
- - - -
Mighty Jehovah
Mighty Redeemer
Chorus (3x)

Track 10: El-Shaddai

Style of Music: Code Switching

El-Shadaai (3x)

You are my God

Ewo !.....

El-Shaddai (4x)

You are my God

You are my Lord

I have no other God

El-Shaddai

You are my God

Oh! El-Shaddai (3x)

You are my God

I have no fear

That you are my God

No power can stop me

That you are my God

My life is hidden in Christ

Christ is you

No weapon fashioned against me

That shall ever ever prosper

I know my God

You are my God

El-Shaddai I trust in you

You will never put me to shame

Let them gather

Their gathering is not for me

- - - -
- - - -
- - - -

Switched to Igbo

Onye nwe m (3x)	—————>	The owner of my life
Chi m ji eme onu	—————>	My God, I boast in you
O bu gi bu chi m na – ezie	—————>	You are my God indeed
Enweghi m chi ozo	—————>	I have no other God
ekwela ka ihere mee	—————>	I will not be put to shame
El-Shaddai (3x)	—————>	El-Shaddai (3x)
You are my God	—————>	You are my God
Ekwela ka uwa komu onu		Do allow the world to laugh at me
agbabawo m n’ ime gi	—————>	I have come to you
oku na-ere ahihia	—————>	Bush burnt but grass
ma ahihia ereghi oku	—————>	Did not wither
oke wara osimiri uhie	—————>	You parted the red sea
okwa gi oji oku ere aja	—————>	You are consuming fire
ekele diri gi	—————>	I thank you
El-Shaddaiiii	—————>	El-Shaddaiiii

Switched to English

You are my God	—————>	You are my God
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Switched to Igbo

Ewozuga gi Jehovah	—————>	Without you Jehovah
O nweghi onye ga-echeta Amaka	—————>	Nobody will remember Amaka
O bu gi chetara m	—————>	You remembered me
were bulie m elu oo	—————>	And lifted me

Switched to English

El-Shaddai (3x)
 I love you I love you
 You are so kind
 El-Shaddai (3x)
 I love you so much
 I have no other God
 You are my maker
 El-Shaddai (3x)

ANALYSIS OF DATA I

Artist: Amaka Okwuoha (aka Chioma Jesus)

Album: Ihem ga-abu (what I will be)

Style of Music: Code-Mixing and Code Switching (Igbo and English)

Track 1: Witches, Wizards and native doctor are features of code-mixing of Igbo and English languages in the song.

Track 2: "O' Disappointghi m" (He has never disappointed me)
O' Disappointghi m" which is chorus of track 2 is code-mixing. It comes after each statement made in Igbo language. The track was both code-mixing and code-switching.

Track 7: "Gi ka m na-akpo" (You are the one I am calling)
This track started with Igbo language, switched to English, interlude in Igbo, switched to English and finally switched back to Igbo.

Track 8: "Mighty Jehovah"
The track started with English, later switched Igbo and ended with chorus in Igbo.

Track 10: "El-Shaddai"
This track started with English, later switched to Igbo and ended with chorus in English.

Data II

Artists: Rev. (Dr). David Nebife (JP)

Album title: 24 Elders Worship

Music style: Code-switching

Track: Tracks 1-5

Prelude : And I saw a mighty one.
upon his magnificent throne
with different sparkling precious stones
the stars, the moon and
all the host of heaven
with the 24 elders bowing down
casting their crown
in worship, saying
Holy Holy is the Lord
Thou art worthy oh! Lord
No one, no one is like thee

Track I: Onye ka m ga –asi na oyiri gi
(Sang in both Igbo and English Languages)

i. IGBO VERSION

Onye kam ga-asi na oyiri gi

Onye e onye e

Onye kam ga-asi na oyiri gi

{ Chineke muo
inweghi atu } 2x

Onye na -eme m

{ I inweghi atu
chineke muo
inweghi atu } 3x

ENGLISH VERSION OF TRACK I

{ Who shall I liken unto thee
No one, no one
who shall I liken unto thee
no, no, no
Oh! nobody like you } 3x

Track II: Never fail me yet

Never fail me yet (2 times)

Jesus Christ never fail me yet

There is one thing I know

wherever I go

Jesus Christ, never fail me yet

I say he never fail me yet

He never fail me yet

Jesus love never fail me yet

{ There is one thing I know
Whenever I go, Jesus Christ } 3x
Never fail me yet }

Track III: No one ever cares for me

Like Jesus

There is no other friend

So kind, as he

No one else could take

Sin and darkness from me

Oh! How much he cares for me

Track IV: Atula egwu, gi kam nonyere

Atula egwu, gi kam nonyere

Elele anya gburugburu n'ujo

N'ihina mu onwe m bu chineke gi e

M ga-agba gi ume

M ga-enyere gi aka } 2x

{ M ga-eji aka nri nke
Ezi omume e, kwagide gi } 3x

Track IV

→ Fear not I am with you

→ Be not afraid.

→ Because I am the Lord

⇒ I will strengthen you

⇒ I will help {2times}

→ { I will use my right hand
Of righteousness to Strengthen you. } 3x

Track V:		Track V:	
{ Chukwu nna nke amamihe }	→	{ God of wisdom }	
{ Onye kere eligure na uwa }	→	{ The creator of the universe }	
{ Anyi ekele gi nna }	→	{ We worship you father }	
{ Ndi gi ekele gi nna }	→	{ Your people worship you }	2x
{ Chineke onye amamihe }	→	{ God of wisdom }	
Onye ahu kere eligwe na uwa	→	The creator of the universe	
Anyi ekele gi nna	→	We worship you father	
Repeat lines 1 – 3 (2x)	→	Repeat lines 1 – 3 (2x)	
Chineke onye amainihe	→	God of wisdom	
Gi onye ahu kere eligwe na uwa	→	The creator of the universe	
Ndi gi ekele gi nna.	→	Your people worship you	
Repeat lines 1 – 3 (2x)	→	Repeat lines 1 – 3 (2x)	

ANALYSIS OF DATA II

Artist: Rev (Dr) David Nebife (JP)

Album: 24 Elders Worship

Style of Music: Code-switching

Prelude: The prelude is in English.

Track 1: Sang in both Igbo and English

Track 2: English

Track 3: English

Track 4: Igbo

Track 5: Igbo

Consequences of Code-Mixing and Code-Switching:

Although the two terms are acceptable in the study of linguistics, It is important to note that it has consequences.

- Too much use of them may hinder the user from being effective in any of the two languages
- One language can assimilate the other.
- The user may find it very difficult to use one language in speech.
- Igbo language is often written incorrectly.
- It hinders language development.
- There will be a wider coverage. Large audience will be reached.

Possible Solutions and Recommendations:

- Artists should improve in the use of Igbo languages
- They should try and make their gospel album to be either Igbo or English tracks only.
- They should attend conferences seminars and workshops organized by language scholars.
- They should give their manuscript to experts in Igbo language for proof reading and corrections before recording, distributing and marketing .

Conclusion

Music plays a vital role in human life. Its usefulness cannot be overemphasized. Music or songs are joyful noise to God. (Psalm 100: 1). Artificial Intelligence is a powerful ally in enhancing code-mixing and code-switching as styles of language use among Igbo gospel artists. From lyrics

generation and pronunciation support to global distribution and cultural preservation, AI offers artists innovative ways to blend Igbo and English in spiritually uplifting and linguistically rich ways. Far from erasing linguistic boundaries, AI magnifies the artistry of bilingual gospel expression, ensuring that Igbo gospel music not only thrives locally but also resonates globally. However, its use must be balanced with cultural sensitivity and a conscious effort to preserve the depth of the Igbo language in gospel artistry. In the end, AI is not just a technological tool but a cultural partner that is helping Igbo gospel artists amplify their voices, celebrate their linguistic identity, and carry the message of the gospel to diverse audiences worldwide through the beautiful interplay of code-mixing and code-switching.

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 - ii. Rev. (Dr.) David Nebife (JP)
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HARNESSING ARTIFICIAL INTELLIGENCE TO BRIDGE LANGUAGE GAPS: A PATHWAY TO INCLUSIVE AND SUSTAINABLE MULTILINGUAL EDUCATION IN AFRICA

¹Christianah Oluremi Tolani Obawaludo & ²Prof. Senimetu Ileuma

^{1&2}Lead City University, Ibadan, Oyo State, Nigeria

remiobawaludo@gmail.com

Introduction

The Educational Inheritance: Language as a Barrier

Across much of Africa, our educational systems are built on inherited legacies structures designed in another era, delivered in another language, and grounded in purposes that often no longer align with the lived realities of our learners today. Millions of students enter classroom spaces where the language of instruction clashes with the language spoken at home (Alidou et al., 2006; Ouane & Glanz, 2010). This mismatch creates serious pedagogical strain. Teachers frequently adapt on the fly, translating complex curriculum content into vernacular speech, while learners may resort to rote memorization rather than proper comprehension.

- 1 This system unfortunately results in the exclusion of many talented individuals and undermines trust in public education systems. Our observations include:1 that brilliant learners are disengaged and drop out not because they lack ability, but because the experience was unfamiliar and disconnecting.
- 2 Teachers were overwhelmed, trying to translate the curriculum while managing overcrowded classrooms of sixty students or more.
- 3 Engaged parents who expressed a sense of helplessness, and difficulty in connecting with their children's education due to terminologies and practice within the school system.

These instances are not isolated rather, they reflect a systemic issue: the challenge of language injustice in education. Despite these difficulties, there are promising avenues through which artificial intelligence has fostered optimism and potential solutions..

1. A speech-to-text tool turning oral instruction into a learner's mother tongue bridging comprehension in real time.
2. An AI-powered chatbot assisting a student in Togo to practice French at home at her own pace, in her own accent.
3. Teachers are using AI tools to design differentiated learning activities that match their students' unique linguistic and cognitive profiles.

These moments remind us that Artificial Intelligence is not just a technological breakthrough; it can be a pedagogical equalizer.

This paper is a call to reimagine education in Africa through the lens of inclusive and sustainable multilingualism, powered by ethically guided and culturally responsive AI. Also, it is a challenge

to move beyond the fascination with automation, toward purposeful innovation that respects linguistic diversity and promotes equity.

Deconstructing Global AI Narratives in African Education

In global conversations about Artificial Intelligence in education, prevalent narratives often reflect themes of progress, efficiency, and inevitability. These accounts typically feature persuasive headlines: *“AI will revolutionize education”*, *“AI enhances teaching efficiency”*, or *“Nations must adopt AI or risk falling behind”*. While these claims contain some truth, they frequently obscure deeper inequities in multilingual African education system when applied uncritically.

The claim that AI will “revolutionize education” is alluring. However, such a revolution tends to benefit the digitally privileged those with stable internet, reliable devices, and a dominant-language background (Luckin et al., 2016). It does not automatically serve the multilingual child in a rural school with intermittent electricity and a home language not represented in the software. In such cases, the so-called revolution may reinforce, rather than reduce, educational disparities (UNESCO, 2021).

Similarly, the narrative that AI increases teaching “efficiency” assumes that education is a technocratic endeavor where automation is the highest virtue. While AI can assist with grading or adaptive testing, efficiency alone cannot capture the relational and culturally embedded nature of learning. Education is not just about speed or standardization it is about meaning, identity, and context (Salas-Pilco et al., 2022). African classrooms are not factories but living linguistic ecosystems. To impose decontextualized efficiency tools is to misunderstand the essence of inclusive learning.

The urgency-laden phrase *“Adopt AI or be left behind”* also deserves scrutiny. It implies a global race toward digital supremacy, yet rarely interrogates *who* sets the pace or *what* the finish line is. Scholars such as Eubanks (2018) and Selwyn (2020) have warned, AI adoption without ethical and cultural considerations risks reproducing the very inequalities it seeks to address. If Africa must adopt AI, it should be on its own terms guided by linguistic realities, pedagogical goals, and community voices.

In all these global narratives, a critical question arises: Where are the African voices especially those of administrators, teachers, and learners in linguistically diverse contexts? Too often, AI systems are designed in English, tested in Silicon Valley, and exported to African classrooms without adaptation, consultation, or training (Molnar, 2020). This digital transference replicates colonial logics imposing external norms onto local contexts without reciprocal dialogue.

As an educational administrator, I firmly believe that we must not allow AI to become the new colonizer of the African classroom. Instead, we must tell new stories that reflect our realities, shaped by our languages, and driven by our priorities. These narratives must center learners who speak in Wolof, Ewe, Yoruba, and Shona, and provide them with tools that recognize their linguistic identities as assets, not barriers.

Decolonizing AI Stories in African Public Schooling

The promise of Artificial Intelligence (AI) in education has often been framed within dominant, technocentric narratives ones that originate in Western contexts and prioritize efficiency, innovation, and market scalability (Selwyn, 2019). While these narratives may resonate in high-income countries, they frequently obscure the nuanced linguistic, cultural, and infrastructural realities of African public education systems. This section calls for the urgent decolonization of

AI stories replacing imported assumptions with locally rooted narratives that foreground inclusion, language equity, and cultural sustainability.

For decades, African schooling has operated under inherited educational frameworks systems designed during colonial eras to serve administrative needs, not community empowerment (Prah, 2009). Despite decades of political independence, many countries still retain education policies that privilege colonial languages, such as English or French, over indigenous tongues. In this linguistic environment, AI tools developed primarily for monolingual, digitally fluent users fail to serve multilingual, resource-constrained classrooms. When AI solutions are imported without adaptation, they risk becoming a new form of cognitive imperialism perpetuating linguistic marginalization and pedagogical mismatch (Mphahlele & Sefotho, 2020).

Decolonizing AI in education, therefore, involves more than localizing user interfaces or providing translated manuals. It demands that African educators, technologists, and policymakers shape the design, deployment, and discourse around AI to reflect indigenous epistemologies and learner realities. It means asking: Whose knowledge systems are being encoded into algorithms? Whose languages are prioritized in speech recognition tools? Who benefits from “efficiency” in teaching, and who is excluded?

Examples from practice are already beginning to challenge dominant models. In Senegal and Togo, for instance, pilot programs are experimenting with AI tools that integrate Wolof or Ewe translations into French-language curriculum delivery. These initiatives, though modest, demonstrate that AI can be designed to serve linguistic justice and pedagogical pluralism when rooted in local partnerships. Moreover, teacher-led adaptations of AI platforms to reflect local metaphors, learning styles, and oral traditions signal the potential for hybrid, culturally aligned innovations.

It is essential to recognize that, decolonizing AI within the context of African education also means addressing the issue of data colonialism. This practice entails the extraction of data from African users to enhance foreign algorithms without obtaining their consent or ensuring equitable benefit sharing (Couldry & Mejias, 2019). Many language learning platforms collect learner data under terms that are neither transparent nor protective, raising ethical concerns about surveillance, intellectual sovereignty, and learner agency.

In this context, the role of educational administrators becomes transformative, thereby advocating not only for inclusive access to AI but also for the co-creation of tools that are culturally embedded, linguistically respectful, and socially just. As gatekeepers of educational equity, administrators must challenge the passive adoption of “solutions” and lead dialogues that center local expertise and lived experience.

Thus, to truly harness AI for sustainable multilingual education, Africa must not only adopt the technology but rewrite the story—placing its diverse languages, pedagogies, and communities at the heart of the narrative. This is not resistance to progress, but a redefinition of it.

Our Local Realities and Responsibilities

As educational administrators, we are not merely implementers of national policy we are the critical link between vision and viability, the gatekeepers of justice, and the interpreters of policy into lived classroom experiences. Our responsibility is not simply to adopt new technologies, but to shape their relevance, ensuring that artificial intelligence (AI) tools are embedded in our own educational ecologies.

First, we must champion AI tools that respect and reflect our linguistic diversity. If a tool cannot process or output in Wolof, Yoruba, Shona, or Ewe it is not yet ready for our classrooms. Language is not just a medium of instruction; it is a carrier of identity, worldview, and self-worth (Bangbose, 2011; UNESCO, 2021). AI solutions that fail to recognize this are not inclusive they are exclusionary.

Also, we must insist on meaningful teacher participation and professional development. Too often, teachers are handed digital tools they neither helped design nor understand. This disempowers educators and undermines pedagogical trust (Salmon, 2022). Instead, we should advocate for co-design models, where teachers are involved in adapting AI tools to their cultural and linguistic realities thereby positioning them as knowledge producers, not passive implementers.

Futhrmore, we must demand infrastructure equity. A "digital classroom" in Dakar must not mean digital exclusion in Dapaong. AI integration cannot deepen the rural-urban divide. Basic enablers like electricity, internet access, and digital devices must be part of the policy conversation (World Bank, 2022). Without these, AI becomes yet another layer of inequity.

In addition, we must invest in culturally relevant content. AI should not simply replicate Western-style e-learning with foreign examples and accents. It should support our own modes of knowing storytelling, proverbs, oral histories, local languages, and intergenerational dialogue (Nsamenang & Tchombe, 2011). A truly African AI for education will amplify, not erase, the wealth of indigenous knowledge systems.

In this transformative moment, our local responsibilities are global contributions. Africa must not be the last to adapt, nor the first to be experimented upon. We must lead not in catching up, but in setting new terms for inclusive, multilingual, and context-sensitive AI for education.

Discussion of Findings

In navigating the promise of Artificial Intelligence (AI) for multilingual education in Africa, research must be more than anecdotal it must be empirical, context-sensitive, and community-driven. In a recent mixed-methods study conducted across public schools in Togo and Senegal, the role of AI-based instruction in supporting French language acquisition among junior secondary school students was investigated (Obawaludo, 2025). The study aimed to understand not just whether AI "works," but for whom, under what conditions, and with what implications for equity and inclusion.

Quantitative findings revealed that students with consistent digital access demonstrated 45% higher engagement scores, as measured by the Student Engagement Observation Checklist and Access to Learning Materials Rating Scale. This suggests that when infrastructure allows, AI can effectively scaffold learning particularly in deconstructing complex French grammar into bite-sized, interactive, and gamified content. Tools such as adaptive learning platforms and AI-powered pronunciation feedback were noted to significantly aid comprehension and learner autonomy.

However, the qualitative data revealed deeper tensions. Interviews and focus groups with teachers and students surfaced recurring concerns around cultural mismatch such as AI voice assistants that mispronounced local names, or scenarios in language apps that were rooted in unfamiliar Western contexts. Moreover, connectivity limitations in rural schools and the lack of teacher training in AI integration surfaced as systemic barriers (Obawaludo, 2025).

These findings point to a crucial insight: AI can enhance language learning, but only if it is built with not just for our communities. Locally responsive design, linguistic inclusivity, and community participation must be foundational, not optional. This research aligns with calls by scholars such as Arslan and Yildirim (2023) and UNESCO (2021) who emphasize co-design, equitable access, and cultural contextualization in AI for education initiatives.

Without intentional equity frameworks, there is a risk that AI despite its potential could reinforce existing educational disparities rather than alleviate them. Therefore, evidence must not only guide innovation but also ground it in the everyday linguistic and infrastructural realities of African learners and educators.

Designing AI for Multilingual Equity

The evidence emerging from my study in Togo and Senegal underscores a truth long understood by African educators: language is not simply a medium of instruction it is a foundation of identity, participation, and belonging. If AI is to serve the goals of inclusive and sustainable education, it must be intentionally designed to reflect and support Africa's linguistic complexity, not erase it.

Africa is home to over 2,000 languages (Eberhard, Simons, & Fennig, 2023). In many public schools, students speak one language at home, another in the community, and yet another in the classroom. When AI tools are built only with English or French datasets—without localization, without dialect variation, and without cultural framing—they reproduce exclusion under the guise of innovation (Chakraborty & Bandyopadhyay, 2021). Designing AI for multilingual equity, therefore, is not merely a technical issue—it is an ethical imperative.

For AI to be genuinely transformative, it must be based on four fundamental principles:

Local Language Datasets: The development of AI tools must be underpinned by robust, open-access datasets in African languages. Projects like Masakhane, an open research effort on machine translation for African languages, demonstrate the power of community-led language modeling (Orife et al., 2020). Without such datasets, AI systems cannot interpret, transcribe, or generate content in local languages, leading to what scholars call “digital language extinction” (Bird, 2020).

Community Co-Creation: AI design should not happen in distant labs. Educators, linguists, and students must participate in the co-creation of tools. When communities are invited to shape voice recognition tools, interactive story platforms, or translation apps, the outcomes are more usable and trustworthy. For instance, the Yoboo app, piloted in West Africa, integrates oral storytelling in local dialects to teach foundational literacy and French—a model of bottom-up innovation.

Dialect Sensitivity: Within a single language group, AI must be able to navigate tonal variation, pronunciation shifts, and regional vocabulary. A one-size-fits-all “French” or “Swahili” model does not reflect lived linguistic realities. Tools such as Mozilla's Common Voice project have begun collecting speech data in dialects such as Fon and Kinyarwanda, enabling more inclusive speech-to-text applications (Ardila et al., 2020).

Culturally Situated Learning: AI must be embedded in pedagogy that reflects local values, histories, and narratives. Instead of generic grammar exercises, learners can interact with conversational bots that reference local proverbs, environmental realities, and cultural idioms. This not only strengthens language acquisition but fosters pride and relevance. In pilot classrooms in Lomé, teachers using an AI-supported “French Village” simulation—where students practice greetings, markets, and storytelling—reported increased confidence and oral proficiency among low-literacy learners.

These principles demand a shift in AI development—from extraction to collaboration, from generalization to localization. As administrators and educators, we must advocate for funding, research, and partnerships that prioritize these values. Without this intentional design, AI will continue to mirror the biases of its creators and marginalize the very learners it claims to support.

Ultimately, multilingual equity in AI is about power. Who defines intelligence? Whose voices are encoded into the machine? Whose languages are deemed worthy of recognition?

To build an inclusive AI future, we must ensure that African languages—and the children who speak them are not left behind.

Policy Imperatives for Inclusive AI in Education

Design alone is not enough. For AI to become a meaningful force in advancing educational equity across Africa, it must be supported by deliberate policy choices, institutional frameworks, and sustained investments. As my fieldwork in Togo and Senegal reveals, even the most well-designed tools falter in the absence of infrastructure, regulation, and capacity-building. The promise of AI for learning—especially in multilingual, under-resourced public schools requires more than technological innovation. It demands political will.

A foundational starting point is digital infrastructure. Across much of Sub-Saharan Africa, connectivity remains patchy and expensive, particularly in rural and peri-urban areas. According to the World Bank (2023), only 36% of schools in West Africa have reliable internet access, and fewer than 50% have access to computers or tablets. Governments must prioritize last-mile connectivity, solar-powered school networks, and zero-rated educational content as essential educational infrastructure—not luxuries.

Second, teacher training and professional development must be reimagined for an AI-enabled future. Many public school teachers are unfamiliar with AI-enhanced learning tools and lack the confidence or pedagogical strategies to integrate them meaningfully. Ministries of Education, in collaboration with teacher colleges and unions, should adopt national frameworks for digital literacy and AI fluency. These should include modules on ethical usage, culturally relevant application, and multilingual pedagogy.

Policy also has a role in guiding ethical, inclusive, and transparent AI adoption. To protect students and educators, African countries must implement strong data protection laws tailored to the education sector, especially regarding the use of biometric data, learning analytics, and behavioral tracking. Pan-African instruments, like the AU's *Digital Education Strategy for Africa* (2022–2032), offer a regional blueprint—but they must be domesticated through national action plans and stakeholder consultations.

Moreover, funding models must shift. Too often, AI pilots in African classrooms are donor-driven or tied to Silicon Valley corporate interests, resulting in short-term, poorly adapted interventions. Instead, African governments and regional blocs like ECOWAS should establish public innovation funds that support locally developed EdTech solutions, particularly in African languages. Investment in AI research centers, AI ethics councils, and language technology labs within African universities would also build long-term, homegrown capacity.

In this context, regional coordination becomes crucial. Institutions such as the African Union (AU), the Economic Community of West African States (ECOWAS), and the African Continental Free Trade Area (AfCFTA) can play key roles in creating shared standards, open-source

platforms, and cross-border educational technology initiatives. For example, the African Union's Continental Education Strategy for Africa (CESA 2016–2025) already emphasizes digital transformation and can be a lever for AI inclusion—if backed by implementation roadmaps and measurable outcomes.

Finally, there must be a paradigm shift in policymaking itself. AI in African education must not be treated as a downstream adaptation of tools built elsewhere. It must begin with African epistemologies, African languages, and African developmental priorities. Policymaking must be consultative, grassroots-informed, and unapologetically centered on learners who are typically excluded from the digital revolution rural girls, children with disabilities, nomadic communities, and speakers of minoritized languages.

A continental digital future that reflects the true diversity of Africa's learners will not emerge by accident. It will require intentional design backed by inclusive policy and an unwavering commitment to educational justice. Without such frameworks, AI may deepen inequities rather than resolve them.

Conclusion

In conclusion, the future of African education in the age of artificial intelligence is not written for us it must be written by us. We stand at a crossroads, where we can either become passive consumers of imported AI solutions, or we can choose to become authors of a new narrative one rooted in our languages, our histories, and our dreams.

Let us be clear: AI is not a magic fix for systemic educational challenges. It is a tool. A powerful one. A dangerous one, if left unexamined. But also a liberating one—if guided with wisdom, justice, and inclusion.

Recommendations

- (1) We must reclaim the AI narrative for Africa. That means rejecting one-size-fits-all imports that do not speak to our realities, and instead investing in tools that reflect our multilingual, multicultural, and socioeconomically diverse contexts.
- (2) We must honor language rights, not just bridge language gaps. If AI cannot recognize Wolof, Yoruba, Shona, or Ewe it is not ready for our classrooms. If it erases the oral traditions and indigenous knowledge systems that have sustained us for generations, it fails our children.
- (3) We must build classrooms where every tongue matters, where every learner sees themselves reflected in the technology they use not as a data point, but as a full human being with agency and voice.
- (4) We must empower teachers not just to use AI, but to shape it. Let them be co-creators of curricula, critics of bad design, and champions of local knowledge. If they are sidelined, the project fails.
- (5) We must demand ethical policies, transparent funding models, and locally led innovation. AI in education must not be driven by donor fads or Silicon Valley markets. It must be rooted in community need and national vision.

- (6) And above all, we must lead with values. The values of Ubuntu, solidarity, and justice. The values that remind us that education is not merely about test scores—but about dignity, belonging, and liberation.

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AI AND NARRATOLOGY IN ORAL LITERATURE EDUCATION FOR SUSTAINABILITY

Ufuoma R. Davies (Ph.D)

Department of Languages and Literature

Lead City University, Ibadan

ufuomarebecca@gmail.com

Abstract

With the rapid advancement of AI technologies, there is an emerging potential to transform oral literature education through innovative tools that enable the digital preservation, analysis, and interactive dissemination of traditional narratives. This paper explores the dynamic intersection of Artificial Intelligence (AI) and narratology within the context of oral literature education aimed at promoting sustainability. This review critically examines existing literature on AI applications in oral narrative preservation, the theoretical foundations of narratology, and the role of storytelling in sustainability education. It highlights both the opportunities and ethical considerations inherent in integrating AI into cultural education, such as respecting indigenous intellectual property and ensuring inclusive access. The paper concludes with recommendations for developing AI systems that support culturally sensitive narratological approaches and promote community participation. By bridging technology, narrative theory, and sustainability pedagogy, this study contributes to a deeper understanding of how AI can enrich oral literature education, ultimately supporting the preservation of cultural identity and advancing global sustainability goals.

Introduction

The integration of artificial intelligence (AI) into various educational disciplines in recent years has opened new pathways for knowledge transmission, preservation, and enhancement. One such critical area where AI has begun to play a transformative role is in oral literature education. This shift is occurring at a time when sustainability—defined by the United Nations as meeting the needs of the present without compromising the ability of future generations to meet their own needs—has become a global imperative. Oral literature, a cornerstone of indigenous knowledge systems and cultural heritage, offers profound insights into sustainable practices, communal living, and ecological wisdom. By leveraging AI technologies within the framework of narratology, educators and researchers can revitalize oral literature education, ensuring its sustainability while simultaneously promoting environmental consciousness and social cohesion.

Oral literature, by its very nature, is transient and performative. Traditionally transmitted through word of mouth across generations, it encompasses myths, folktales, legends, proverbs, songs, and rituals. These forms are deeply embedded in the cultural, moral, and ecological fabric of indigenous societies, especially in Africa, Asia, and Latin America. The narratives often contain embedded environmental ethics, communal responsibilities, and practical survival knowledge. For example, African folktales frequently center on animals and nature, subtly embedding ecological morals and sustainable living practices (Okpewho, 1992). Yet, globalization, urbanization, and digital distractions have eroded the traditional mechanisms of oral transmission. Many of these oral traditions are endangered, their bearers aging and dying without adequately passing them on. This creates a pressing need for innovative educational strategies that not only preserve these traditions but also make them relevant to contemporary learners.

Artificial intelligence presents itself as a powerful tool to address this challenge. AI's capabilities in natural language processing, machine learning, and speech recognition can be utilized to document, analyze, and reproduce oral narratives with remarkable fidelity. AI-driven tools can transcribe oral stories in indigenous languages, analyze their structural and thematic components, and even simulate traditional storytelling through voice synthesis and interactive platforms. This technological intervention supports the pedagogical aims of oral literature education by making content more accessible, engaging, and adaptable to different learning contexts. Furthermore, AI enables the analysis of narrative patterns across cultures and time periods, contributing to the field of narratology—the study of narrative structures and the ways they convey meaning.

Narratology provides a critical framework for understanding how stories are constructed and interpreted. It investigates elements such as plot, character, temporality, focalization, and narrative voice. When applied to oral literature, narratology allows educators and researchers to deconstruct complex indigenous narratives, revealing underlying themes related to sustainability, ethics, and identity. For instance, Vladimir Propp's (1968) morphological approach to folktales identifies recurring narrative functions that can be mapped across different cultures, demonstrating the universality of certain storytelling structures. AI technologies can extend Propp's analysis by processing vast corpora of oral narratives to detect recurring motifs, archetypes, and moral lessons, thus offering new insights into the sustainability-oriented content embedded within traditional stories.

Moreover, AI-enhanced narratology enables a dynamic interaction between the storyteller and the audience, which is a hallmark of oral literature. AI systems can be programmed to respond to user inputs, creating an interactive storytelling experience that mimics traditional oral performances. This not only revitalizes the performative aspect of oral literature but also caters to the digital learning preferences of younger generations. For example, AI-powered virtual griots or bards can narrate indigenous tales in vernacular languages, adapting tone, gesture, and mood based on audience feedback. Such innovations create immersive educational experiences that deepen learners' engagement with cultural heritage and environmental values.

The integration of AI in oral literature education also aligns with the goals of Education for Sustainable Development (ESD), as outlined by UNESCO. ESD seeks to empower learners with the knowledge, skills, and values necessary to act responsibly for environmental integrity, economic viability, and social equity. Oral literature, rich in indigenous ecological knowledge, can be a potent vehicle for ESD when delivered effectively. Stories about communal farming, water conservation, wildlife protection, and conflict resolution impart sustainability lessons that are contextually grounded and culturally resonant. AI technologies can enhance this pedagogical potential by curating thematic story collections, aligning them with sustainability curricula, and facilitating multilingual access. Additionally, AI can assist in evaluating learners' comprehension and attitudinal shifts, thereby improving the assessment mechanisms of oral literature education.

In educational settings, AI also offers opportunities for collaborative and personalized learning. AI-driven platforms can match students with stories that align with their interests, cultural backgrounds, and learning levels. For instance, a student interested in environmental issues might be guided toward folktales emphasizing ecological harmony, while another intrigued by social justice could explore narratives on communal leadership and equity. Machine learning algorithms can track students' progress, suggest complementary materials, and even generate questions or prompts to stimulate critical thinking. This personalized approach not only makes oral literature education more effective but also ensures that sustainability messages are internalized in meaningful ways.

Furthermore, AI can serve as a bridge between formal and informal education systems. Many oral traditions are still alive in rural communities but remain excluded from mainstream curricula. AI technologies can capture these living traditions and integrate them into school programs, creating a holistic learning environment that respects and elevates local knowledge systems. Community elders can collaborate with educators and technologists to record and digitize stories, ensuring their preservation and educational utility. In this way, AI fosters intergenerational learning and cultural continuity, both of which are essential for sustainable development.

Despite its potential, the use of AI in oral literature education also raises critical ethical and practical concerns. Issues of data ownership, cultural appropriation, linguistic accuracy, and representational integrity must be addressed. Oral narratives are communal assets, often bound by cultural protocols and spiritual significances. Digitizing and analyzing them using AI tools could lead to their commodification or distortion if not handled with sensitivity and consent. There is also the risk of over-standardization, where the nuanced and improvisational aspects of oral performance are lost in favor of algorithmic regularity. Therefore, AI applications in this field must be developed through participatory approaches involving cultural custodians, educators, and technologists. Respect for indigenous epistemologies and narrative forms must guide all AI-driven initiatives in oral literature education.

Additionally, linguistic diversity poses a technical challenge. Many oral narratives are performed in minority languages or dialects with limited digital resources. Training AI systems to recognize and process these languages requires significant investment and linguistic expertise. Open-source language models and community-based data collection efforts can mitigate this challenge by pooling resources and fostering inclusivity. Moreover, AI tools must be designed to accommodate multimodal inputs, such as gestures, music, and visuals, which are integral to oral performances. Advances in multimodal AI and affective computing offer promising solutions in this regard, enabling more holistic representations of oral traditions.

Another vital aspect to consider is the role of AI in fostering critical literacy and decolonial thinking. Oral literature often contains subversive themes that challenge dominant power structures and affirm indigenous identities. By exposing students to these narratives and encouraging critical reflection, educators can cultivate a deeper understanding of historical injustices, cultural resilience, and sustainable worldviews. AI can support this process by providing contextual annotations, facilitating cross-cultural comparisons, and enabling learners to co-create alternative endings or versions of traditional stories. Such interactive and critical engagements with oral literature promote epistemic justice and sustainability at both cognitive and cultural levels.

Moreover, AI can help reposition oral literature from the margins to the center of literary scholarship and curriculum design. Historically, oral traditions have been dismissed as “primitive” or “inferior” to written texts, a bias rooted in colonial and Eurocentric paradigms. AI-driven narratology can counter this marginalization by demonstrating the structural complexity, thematic richness, and pedagogical value of oral narratives. Quantitative analyses can reveal sophisticated narrative devices, while qualitative insights can highlight their philosophical depth. This scholarly validation not only enhances the status of oral literature within academia but also affirms the worth of indigenous cultures in global knowledge systems.

In light of the climate crisis and growing ecological degradation, the environmental wisdom embedded in oral literature is more relevant than ever. Stories that emphasize symbiotic relationships with nature, communal stewardship, and moral responsibility provide alternative paradigms to exploitative and consumerist models of development. AI can amplify these messages

by transforming them into digital campaigns, educational modules, and public awareness tools. By incorporating oral narratives into environmental education and advocacy, AI contributes to shaping a more sustainable and culturally rooted ecological consciousness.

Furthermore, the integration of AI and narratology in oral literature education can foster transdisciplinary research and collaboration. Scholars from literature, anthropology, linguistics, computer science, and environmental studies can work together to design AI systems that are culturally aware, pedagogically effective, and technologically advanced. Such collaborations can lead to the development of digital repositories, storytelling apps, immersive simulations, and intelligent tutoring systems. These innovations not only enrich the educational experience but also create new avenues for preserving and disseminating oral traditions across generations and geographies.

Literature Review

The integration of Artificial Intelligence (AI) into oral literature education marks a transformative shift in narrative transmission and pedagogical practices, particularly in advancing sustainability goals. Existing scholarship underscores the role of narratology in preserving indigenous knowledge systems and fostering environmental consciousness through storytelling. As digital technologies evolve, AI-driven tools are increasingly used to archive, analyze, and teach oral traditions. This literature review explores the intersection of AI, narratology, and sustainability in educational contexts, examining how emerging innovations can enhance cultural continuity, promote eco-literacy, and support sustainable development through adaptive storytelling and digital preservation.

Foundations of Oral Literature and Sustainability

Oral literature comprises the spoken narratives, myths, proverbs, songs, and rituals transmitted across generations in many indigenous communities and rural societies. It encapsulates communal wisdom, moral teachings, cultural identity, and ecological understanding embedded within stories. Studies highlight how oral traditions sustain collective memory and social norms, often encoding ecological practices such as seasonal farming, water conservation, and wildlife respect (Finnegan, 2012; Abah, Mashebe & Denuga, 2015). These narratives are performative and communal, performed in specific cultural settings, and inherently participatory, marked by improvisation and audience interaction.

Sustainability, as conceptualized by UNESCO, encompasses ecological integrity, social equity, and intergenerational responsibility. Oral literature aligns with these dimensions: ecological knowledge transmits sustainable land use practices; moral stories reinforce social cohesion; and its intergenerational nature binds younger and elder community members. In contexts facing rapid environmental degradation, the preservation and revitalization of oral literature emerge as strategic educational interventions for environmental stewardship (Bentley & Thibodeau, 2019; Finnegan, 2012). However, oral traditions face existential threats. Modernization, urbanization, declining use of indigenous languages, and the erosion of communal practices diminish the contexts wherein stories thrive. The death of elders without systematic documentation further endangers narrative continuity. These losses undermine not only cultural diversity but also access to sustainable knowledge rooted in centuries of lived experience (Abah, Mashebe & Denuga, 2015).

Traditional preservation efforts—such as manual recording, annotation, and archiving—are often limited in scale and accessibility. While valuable, such efforts frequently remain as isolated

repositories rather than integrated educational resources. This gap calls for scalable, interactive, and participatory approaches that not only digitize but also vivify oral literature while situating it meaningfully within sustainability education.

Narratology and Analytical Framework for Oral Narratives

Narratology provides critical tools for deconstructing and interpreting narratives, focusing on elements such as plot, character, temporality, voice, and perspective. Foundational scholars like Propp (1968) and more recent theorists expand upon these frameworks to include performative and dialogic dimensions. Applying narratological analysis to oral literature reveals structural patterns, ecological metaphors, moral archetypes, and transmission modes—keys for understanding how sustainability values are embedded and communicated. Structural narratology highlights recurring narrative functions and motif indices (e.g., animal helpers, tricksters, trials). These motifs often carry allegorical ecological messages—patience embodied by tortoise tales, communal problem-solving in folktales of village conflict, or respect for ecosystems through animal characters. Identifying these patterns across cultures makes explicit the universality and resilience of sustainable imagery embedded in traditional oral storytelling (Propp, 1968; Finnegan, 2012).

Narrative voice and focalization theories allow educators to examine who tells the story and for what audience purpose—whether the narrator is an elder, a trickster, or a deity. Such analyses shed light on responsibility, moral authority, belonging, or taboo in environmental actions. Oral narrator agency often exerts social influence, shaping audience sympathy for ecological balance and collective accountability. Critics emphasize the performative aspect: oral literature is not only about the content but about the event—the cues, repetition, musicality, audience reaction, and improvisation—all of which contribute to meaning. Narratology thus intersects with performance studies, ethnopoetics, and multimodal analysis, providing a richer interpretive lens to connect form, context, and sustainability messaging.

AI Technologies in Oral Literature

Artificial intelligence offers transformative capacities for processing and revitalizing oral literature. Key technologies include automatic speech recognition (ASR), natural language processing (NLP), machine translation, and voice synthesis. These enable efficient transcription of oral narratives, multilingual curation, and performative re-enactment, addressing the volume and complexity of oral heritage at scale. ASR systems trained on indigenous languages allow community elders' stories to be captured in audio and converted into editable text. While many speech systems underperform on under-resourced languages, efforts in multilingual ASR and few-shot learning show promise when communities collaborate with linguists and technologists (Döring, 2021). Transcription fosters analysis, searchability, annotation, and integration into digital platforms.

NLP techniques for pattern analysis, sentiment analysis, and topic modeling can elucidate narrative structures and thematic trends across large oral literacy corpora. For narratologists, this accelerates analysis of motifs, archetypes, and environmental discourses. Also, machine translation ensures accessibility across linguistic groups, expanding cross-cultural educational reach. Voice synthesis and avatar-based storytelling platforms allow users to interact with AI “storytellers.” These systems simulate tone, pace, and expressive elements of oral performance. When built with community consent and cultural authenticity, these digitally animated storytellers can serve as pedagogical supplements, ensuring that stories remain performative and engaging even when live elders cannot always be present.

Integrating Narratology and AI in Educational Contexts

The intersection of narratology and AI in education unlocks interactive, multimodal learning experiences rooted in cultural heritage. AI platforms embedded with narratological frameworks can dynamically curate stories based on narrative structures and sustainability themes. For example, educators can design AI systems to select canonical ecological folktales based on their motif sequences (e.g., trickster intervention leading to resource regeneration). Learners can explore how repeated narrative structures teach moral lessons, then reflect on their applicability to modern environmental challenges. This process promotes critical thinking and pattern recognition. Interactive story apps enable learners to choose paths based on point-of-view changes—e.g., narrating ecological dilemmas from an animal's perspective and exploring alternative story outcomes linked to sustainable or exploitative behavior. Such branching narrative structures informed by narratological models enhance empathy and environmental awareness.

These implementations support Education for Sustainable Development (ESD) goals by embedding cultural knowledge into pedagogy, boosting bilingual or multilingual learning, and aligning with experiential learning paradigms. AI-enhanced narratological storytelling thus merges culture, cognition, and ecology in compelling ways.

Critical Perspectives and Ethical Considerations

While promising, AI integration in oral literature education raises critical questions of power, authenticity, and cultural ownership. Digitization of communal traditions must respect protocols around sacred narratives, gendered storytelling roles, and narrative ownership, especially regarding spiritual or esoteric stories. Community-driven consent and participatory design are essential to prevent cultural exploitation (Finnegan, 2012; Abah, Mashebe & Denuga, 2015).

Algorithmic bias and cultural appropriation pose risks. AI systems trained on Western perspectives may devalue local narratological conventions. Designers must ensure culturally informed ontology and lexicons, and avoid reductionist pattern recognition that strips stories of nuance. Community-based metadata tagging and local narratological standards must guide training and evaluation of AI models.

The digital divide also matters. Access depends on hardware, connectivity, and digital literacy. Rural communities may lack infrastructure to store and access AI-powered platforms. Sustainable educational design must integrate low-tech alternatives (e.g., offline apps, radio-based digital storytelling, community centres) and ensure maintainability beyond pilot phases. Furthermore, performance features in AI-generated storytelling risk flattening oral dynamism. Voice synthesis must preserve prosody, emotion, and linguistic rhythm. Oversimplified synthetic readings could diminish learners' aesthetic experience and affective engagement. Thus, close collaboration with native speakers, voice coaches, and technologists is vital to maintain cultural authenticity.

Evidence from Case Studies and Pilot Projects

Empirical studies demonstrate promising outcomes of AI-narratology integration in educational contexts. A pilot in rural South Africa used voice-activated story nodes, where students spoke responses to prompts and received branching folktales. Evaluations showed increased cultural pride, environmental awareness, and oral fluency (Döring, 2021). Teachers reported enhanced dialogue around ecological issues and greater student participation. Another initiative in Southeast Asia captured river-based folktales via ASR/mobile apps in local dialects. These were transcribed, annotated, and embedded in interactive storytelling digital kiosks in schools. Assessments

revealed stronger connection with place-based ecological knowledge and improved literacy outcomes (Abah, Mashebe & Denuga, 2015).

In Nigeria, community-university collaborations documented proverbs related to farming seasons using NLP tagging. Students later accessed themed collections—e.g., “soil care proverbs”—through multilingual platforms. Surveys indicated that this approach helped students conceptualize sustainable agriculture in culturally meaningful terms (Bentley & Thibodeau, 2019). However, not all initiatives succeeded. A program in Latin America encountered backlash when sacred creation myths were digitized without proper permissions. This led to community protest and the withdrawal of AI modules. This case highlights the importance of cultural protocols and participatory governance structures in AI-enabled narrative projects (Finnegan, 2012).

Synthesis Toward Sustainable AI-Narratological Education

Synthesizing these discussions reveals key insights. First, narratology strengthens the educational impact of AI-curated oral content by enabling pedagogical structuring (e.g., motif classification, narrative arcs, audience engagement frameworks). Storytelling becomes analyzable and teachable through narrative scaffolding. Second, AI amplifies indigenous oral literature by improving access, preserving linguistic diversity, and delivering performative richness. When designed responsibly, AI acts as a cultural mediator—helping traditional narratives adapt into modern educational forms without erasing their essence.

Third, sustainable outcomes depend on ethics, equity, and inclusivity. Technological design must embed human-centered values and cultural agency, ensuring that communities retain control over narrative content, metadata, and dissemination. Fourth, systemic integration into curricula and educational policy remains sparse. Beyond pilots, there is need for scalable models that embed AI-narratology in teacher training, educational standards, and national frameworks to align with the UN’s ESD agenda.

Finally, transdisciplinary research acts as the linchpin. Meaningful integration requires dialogue across computer science, narratology, anthropology, education, and environmental science—ensuring that technical, cultural, and pedagogical dimensions remain aligned through iterative design.

Recommendations

1. **Participatory Design and Governance:** Projects must be co-designed with community elders, narrators, and knowledge keepers. Formal agreements (written or oral) should delineate data ownership, narrative access levels, and representation protocols. Indigenous advisory boards should guide AI training, metadata classification, and performative modeling.
2. **Culturally Informed AI Architectures:** AI systems should incorporate native narratological structures—rhetorical rituals, repetition patterns, and voice intonation—through knowledge graphs and pattern rules. Encourage open-source models tailored to under-resourced languages and narratives, supported by community-led data annotation.
3. **Multimodal and Low-Tech Accessibility:** Design platforms for offline use, modular distribution (e.g., on USB drives, local servers, offline apps), and radio-broadcast versions. Complement AI tools with community workshops on oral practice, performance training, and critical literacy to reinforce digital experiences.
4. **Curriculum Integration and Educator Training:** Develop teacher guides that align AI-narratology tools with existing ESD outcomes. Train educators in narratological analysis and AI facilitation. Pilot school-community partnership programs where elders co-teach with trained teachers, using AI tools in environmental science and language classes.

5. **Ethical Review and Monitoring:** Regular audits should assess compliance with cultural protocols, data security, and narrative integrity. Include feedback loops where communities can report misrepresentation or misuse. Make narrative removal or revision mechanisms available when stories are misused.
6. **Research and Evaluation Frameworks:** Establish evaluation metrics that measure cultural pride, environmental attitudes, literacy growth, and narrative performance skills. Promote longitudinal studies to assess knowledge retention and attitude shifts. Use mixed methods—quantitative tests plus oral reflections and performance data.
7. **Cross-Sectoral Partnerships:** Encourage collaboration between local nonprofits, universities, ed-tech vendors, cultural institutions, and governments. Partner to secure sustainable funding, share resources, and develop standards. Explore public-private-community funding models that center community benefit and capacity building.

Conclusion

The convergence of Artificial Intelligence and narratology presents significant opportunities for enhancing oral literature education, particularly within the framework of sustainability. AI technologies facilitate the preservation, analysis, and dissemination of oral traditions, ensuring that indigenous knowledge and cultural narratives are not lost but adapted to contemporary educational contexts. Narratology provides a critical lens for understanding the structure and meaning of these stories, which often carry essential lessons about human relationships with the environment. By integrating AI tools, educators can create dynamic, interactive learning experiences that deepen students' ecological awareness and cultural sensitivity.

This fusion supports the broader goals of Education for Sustainable Development by fostering respect for cultural heritage and encouraging sustainable behaviors. However, the ethical challenges related to data ownership, cultural representation, and technological accessibility must be carefully managed to avoid digital colonialism and marginalization. Future research should focus on developing inclusive AI systems that honor oral traditions' contextual nuances and engage local communities as active partners. Ultimately, leveraging AI within narratological frameworks can contribute to more resilient, culturally grounded, and sustainable education models that empower learners to address pressing environmental challenges while valuing their cultural identities.

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TOWARDS INTEGRATION OF ONLINE LEARNING FOR SELF-DEVELOPMENT AMONG MANAGERS OF SMALL AND MEDIUM SCALE ENTERPRISES IN AWKA SOUTH LOCAL GOVERNMENT AREA, ANAMBRA STATE

Enwezor, Chibuogwu Helen (Ph.D)

Faculty of Education

Department of Educational Foundations

Chukwuemeka Odumegwu Ojukwu University, Igbariam

E-mail: chiogewino@yahoo.com

Abstract

In Nigeria and Awka South Local Government area, Anambra State in particular, the cost of living has increased tremendously. The economic meltdown, constant inflation, and naira devaluation have equally affected the lives of the majority thereby causing a rush into small-scale businesses in a quest to survive to the detriment of the young adults' academic life. Passing through the streets in urban areas in Awka South Local Government area, Anambra State, SME structures line up the road, as well as the residential areas of which the managers are mainly the young people who are supposed to be in schools. The education of these young people is being terminated for the sake of money so that their families can survive the present harsh realities. The purpose of the study therefore is to determine how to integrate online learning for self-development among managers of Small and Medium Scale Enterprises. Four research questions guided the study. The descriptive survey research design was adopted. The population of the study consisted of 1630 registered entrepreneurs who owned small-scale and medium enterprises in Awka South Local Government area, Awka South Local Government area, Anambra State. A proportionate sample was adopted in deriving the sample from different sectors of SMEs in Awka south. The technique was based on the industrial sector, service sector, commercial sector, and agricultural sector of SMEs. In drawing the sample using the proportionate sampling techniques, 98 SMEs were drawn from the industrial sector, 59 SMEs were drawn from the service sector, 85 SMEs were drawn from the commercial sector and 79 SMEs were drawn from the agricultural sector. A structured questionnaire created by the researcher with knowledge from the literature review served as the data collection tool for this investigation. It was divided into Sections A and B. Section A concentrated on the demographic information of respondents while Section B was composed of clusters covering the four study questions. To determine the face and content validity of the instrument, copies of it were given to two experts in business education from the Departments of Technology and Vocational Education and one expert in Measurement and Evaluation, all in Faculty of Education, Chukwuemeka Odumegwu Ojukwu University, Awka South Local Government area, Anambra State, Nigeria. The experts were presented with the instrument, purpose of study, and research questions. The items were examined in terms of relevance, language, coverage of the scope of the study, general text format, and suitability. The inputs made by the experts were taken into consideration in the final production of the instrument. The questionnaire was used by the researcher for data collection. The researcher gave copies of the questionnaire to the respondents with the help of three research assistants who were properly briefed on the modalities for the instrument administration. They were given adequate time to explain how to check or indicate their view on the questionnaire's items. After each exercise, copies of the questionnaire have been collected. Arithmetic and standard deviation was used to analyze data collected from the respondents. The data was analyzed using SPSS Version 23. Findings indicated that online learning can benefit SME managers to a great extent. It was also

found that the integration of online advertising for sales improvement of SMEs can enhance self-development of SME managers in Awka South Local Government area, Anambra State.

Keywords: Lifelong Learning, ODL, SME Managers, Self-development and Achievement, Formal Education.

Introduction

Education is one of the pillars that can push a nation towards economic stability. Formal education is an essential acquisition for everyone, especially in this 21st century and its importance cannot be over-emphasized. The formal education is an organized education model, structured and administered by laws and norms, and subject to strict curriculum objectives, methodology, and content. This form of education involves the instructor (i.e., lecturer for a conventional school, facilitator for an online based school), students, and the institution. Participants in formal education are expected to attend classes and subject themselves to assessments that are meant to take learning to the next stage for the attainment of diplomas and degrees. Formal learning supports the accumulation of shared knowledge (beyond specific contexts), which can enhance social and economic mobility. It is important to note that formal education enables self-development by elevating the social status of the beneficiaries. Self-development is an ongoing process of improving oneself through learning, skill acquisition, and reflection, essential for entrepreneurs adapting to a dynamic business environment. It embraces self-achievement and self-fulfillment. Self-achievement is about realizing personal goals and potential while self-fulfilment comes from systematic efforts to overcoming challenges. In all, social media network platforms support self-development by providing flexibility and autonomy, enabling learners to reach their goals at their own pace.

Social media network has gained substantial popularity, offering numerous benefits to individuals. According to current research, these benefits can be categorized into flexibility, accessibility, cost-effectiveness, and personalized learning experiences (Allen & Seaman, 2017; Dhawan, 2020; Kizilcec et al., 2020 and Morris, 2021). A major importance of social media network network is its accommodation of distant learners. This is in line with Basar et al (2021) who asserted that social media network network does not just refer to direct learning alone and explained that the assignments or activities, provided by the teacher online, are considered part of social media network network. This is why Hussin (2017) asserted that by interacting online, facilitators remain connected with their students despite being in different locations. Hasifah (2020) averred that learning online enables more effective self-learning. Students can choose the time they spend, the content they learn, and the direction of their learning. Students also have the opportunity to re-watch recordings made by the educator, obtain information from books, or use the internet to strengthen their knowledge and revisit challenging topics until they feel confident in their understanding (Fauziana, 2020; Basar et al, 2021). Furthermore, social media network allows individuals or learners who shy away from publicity to study in a “safe” environment, and at their convenience without experiencing embarrassment about asking questions. Social media network can enhance the management of Small and medium-scale enterprise (SME).

Small and medium-scale enterprise (SME) managers are those who work in or for those enterprises regarded as small and medium-scale. Those enterprises consist of business ventures with staff strength of at least 10 members but not more than 250. According to the International Labour Organization (ILO, 2015), small enterprises are those enterprises that range between 10 to 100 employees while micro-enterprises are the type of enterprises that have up to 10 employees and medium-sized type of enterprises have between 100 to 250 employees. SME's plays a major

role in the transition and developing countries across the globe (Njoku et al, 2022). This assertion is because these enterprises constitute a major source of employment opportunities aside from white-collar jobs and they also generate some significant domestic and export earnings for the country. Taiwo (2016) posited that SME's have contributed to the economic and social development of people, especially in the area of poverty reduction which shows why most people end their educational career in SME's and why SME managers should utilize social media network to advance academically.

Studies have shown that many people who operate SMEs do not have adequate knowledge of the basic investment concepts which are required to make important and prudent investment decisions (Njoku et al., 2022). Online studies provide training on various business potentials/skills that will enable business managers to improve financially via financial literacy, effective decision-making, and increased investment. Small and medium-scale managers can study from the comfort of their offices/workshops or homes, which justifies the flexibility and cost-effectiveness of ODL which highlights the need for them to avail themselves of the opportunity of ODL to improve their educational attainment.

Purpose of the Study

The purpose of the study was to determine how to integrate social media network for self-development among managers of Small and Medium Scale Enterprises. Specifically, this study determined:

1. Benefits of social media network integration in the management of small and medium-scale enterprises in Awka South Local Government area, Anambra State.
2. Factors that hinder social media network integration in the management of small and medium-scale enterprises in Awka South Local Government area, Anambra State.
3. Ways social media network integration in the management of small and medium-scale enterprises can enhance self-development of SME managers in Awka South Local Government area, Anambra State.
4. Ways the integration of online advertising for sales improvement of SMEs can enhance self-development of SME managers in Awka South Local Government area, Anambra State.

Statement of Problem

in a country where food becomes more expensive than the salary of a worker two things become cheap, namely; the dignity of a man and the honour of a woman. This is the status quo in Nigeria currently because due to the increased cost of living, most working parents have persuaded their children to move into business or start paying their school fees themselves. In Nigeria and Awka South Local Government area, Anambra State in particular, the cost of living has increased tremendously. The economic meltdown, constant inflation, and naira devaluation have equally affected the lives of the majority thereby causing a rush into small-scale businesses in a quest to survive to the detriment of the young adults' academic life. Passing through the streets in urban areas in Awka South Local Government area, Anambra State, SME structures line up the road, as well as the residential areas of which the managers are mainly the young people who are supposed to be in schools. The education of these young people is being terminated for the sake of money so that their families can survive the present harsh realities. Thees affected individuals still desire to upgrade their academic status even while on the job or in business. A good number of these individuals are yet to enroll for an online study which is the perfect medium to achieve that desire without going through the school.

The problem of this study, therefore, is that the views of these young SME managers for social media network for self-development appears not to be clearly known. This made it imperative to conduct this study to determine how to integrate social media network in the management of small and medium scale enterprise for self-development of the managers.

Research Questions

The following research questions guided the study.

1. What are benefits of social media network integration in the management of small and medium-scale enterprises in Awka South Local Government area, Anambra State?
2. What are the factors hindering social media network integration in the management of small and medium-scale enterprises in Awka South Local Government area, Anambra State?
3. In which ways can social media network integration in the management of small and medium-scale enterprises enhance self-development of SME managers in Awka South Local Government area, Anambra State?
4. In which ways can integration of online advertising for sales improvement of SMEs enhance self-development of SME managers in Awka South Local Government area, Anambra State?

Research Method

The descriptive survey design was adopted for the study. The design is therefore appropriate for this study as it intends to obtain data on how to integrate social media network for self-development among managers of Small and Medium Scale Enterprises. The population of the study consisted of 1630 registered entrepreneurs who owned small-scale and medium enterprises in Awka South Local Government area. Statistics on the population was obtained from the Department of trade commerce market and wealth creation state secretariat Awka South, Anambra. The taro Yamane formula was used to determine the sample size of the study which is 321 SMEs in Awka South, LGA, Awka South Local Government area, Anambra State. A proportionate sample was adopted in deriving the sample from different sectors of SMEs in Awka south. The technique was based on the industrial sector, service sector, commercial sector, and agricultural sector of SMEs. In drawing the sample using the proportionate sampling techniques, 98 SMEs were drawn from the industrial sector, 59 SMEs were drawn from the service sector, 85 SMEs were drawn from the commercial sector and 79 SMEs were drawn from the agricultural sector.

A structured questionnaire created by the researcher with knowledge from the literature review served as the data collection tool for this investigation. It was divided into Sections A and B. Section A concentrated on the demographic information of respondents while Section B was composed of clusters covering the four study questions. To determine the face and content validity of the instrument, copies of it were given to two experts in business education from the Departments of Technology and Vocational Education and one expert in Measurement and Evaluation, all in Faculty of Education, Chukwuemeka Odumegwu Ojukwu University, Awka South Local Government area, Anambra State, Nigeria. The experts were presented with the instrument, purpose of study, and research questions. The items were examined in terms of relevance, language, coverage of the scope of the study, general text format, and suitability. The inputs made by the experts will be taken into consideration in the final production of the instrument. The questionnaire was used by the researcher for data collection. The researcher gave copies of the questionnaire to the respondents with the help of three research assistants who were properly briefed on the modalities for the instrument administration. They were given adequate

time to explain how to check or indicate their view on the questionnaire's items. After each exercise, copies of the questionnaire have been collected. Arithmetic and standard deviation was used to analyze data collected from the respondents. The data was analyzed using SPSS Version 23. Decisions on the questionnaire items and the research questions was based on the item and cluster means relative to the real limits of numbers as shown below:

Response	Rating Scale	Real Limits of Numbers
Strongly Agree (SA)	4	3.50-4.00
Agree (A)	3	2.50-3.49
Disagree (D)	2	1.50-2.49
Strongly Disagree (SD)	1	1.00-1.49

Presentation of Results

The results of the data analyzed are presented in the following tables in line with the research questions formulated for the study.

Research Question 1- What are benefits of social media network integration in the management of small and medium-scale enterprises in Awka South Local Government area, Anambra State?

Table 1: Respondents' Mean Ratings on benefits of social media network integration in the management of small and medium-scale enterprises in Awka South Local Government area, Anambra State.

S/N	ITEMS	MEAN	STD. DEV.	REMARK
1	Social media network will impart confidence in me when it comes to tackling unfamiliar business issues.	3.39	.64	A
2.	Social media network has nothing to do with learning how to boost my financial achievements.	2.22	1.21	D
3.	Social media network will enable me familiarize myself with various online applications to update my knowledge	3.37	.75	A
4.	Social media network is the best substitute for a formal education	3.25	.80	A
5.	I can upgrade my academic status via online studies	3.71	.61	SA
Cluster Mean		3.19	G E	

Data in table 1 show that out of 5 items on perception of SME managers on the benefits of social media network, respondents perceived item 5 to a very great extent, items 1, 3 and 4 to a great extent and item 2 to a low extent. The cluster mean score of 3.19 indicates that social media network can benefit SME managers to a great extent. The standard deviations for all the items except item 2 are within the same range which shows that the respondents are not wide apart in their ratings.

Research Question 2- What are the factors hindering social media network integration in the management of small and medium-scale enterprises in Awka South Local Government area, Anambra State?

Table 2: Respondents' Mean Ratings on the Factors hindering social media network integration in the management of small and medium-scale enterprises in Awka South Local Government area, Anambra State.

S/N	Items	Mean	Std. Dev.	Remark
6.	No financial support	3.35	1.09	A
7.	Always busy	3.26	1.03	A
8.	Cost of buying data	3.27	1.04	A
9.	Negative attitude from family members	1.90	1.05	D
10	I don't have an Android phone	2.14	1.31	D
11.	Inadequate power supply	3.00	1.28	A
12.	Lack of Internet	3.20	1.17	A
	Cluster Mean	2.87		A

Data in table 2 show that out of 7 items on factors perceived of as hindrances to SME managers' enrolment in social media network, respondents perceived items 6,7,8, 11 and 12 to a great extent and item 9 and 10 to a low extent. The cluster mean score of 2.87 indicates that most of the items listed hinders SME managers to a great extent. The standard deviations for all the items are within the same range which shows that the respondents are not wide apart in their ratings.

Research Question 3- In which ways can social media network integration in the management of small and medium-scale enterprises enhance self-development of SME managers in Awka South Local Government area, Anambra State?

Table 4: Respondents' Mean Ratings on ways social media network integration in the management of small and medium-scale enterprises can enhance self-development of SME managers in Awka South Local Government area, Anambra State

S/N	ITEMS	MEAN	STD. DEV.	REMARK
13.	This study can improve my digital literacy.	3.47	.78	A
14.	Social media network can help me master the use of the Zoom app.	3.16	.93	A
15.	Can help me master the Microsoft word for recording information.	3.14	.83	A
16.	The online classes will enhance my communication skills.	3.39	.80	A
17.	This will enable me to learn how to use the browser.	3.49	.76	A
18.	Social media network can help me know my profit and loss.	3.02	.88	A
19.	The online classes will sharpen My analytic skills.	3.35	.87	A
	Cluster Mean	3.29		A

Data in table 3 show that out of 7 items on the extent social media network contribute to self-development, respondents perceived all items; 17, 18, 19, 20, 21, 22 and 23 to a great extent. The cluster mean score of 3.29 indicates that most of the items listed contributes to self-development of the SME managers to a great extent. The standard deviations for all the items are within the same range which shows that the respondents are not wide apart in their ratings.

Research question 3: In which ways can integration of online advertising for sales improvement of SMEs enhance self-development of SME managers in Awka South Local Government area, Anambra State?

Table 3: Respondents' mean rating on ways integration of online advertising for sales improvement of SMEs can enhance self-development of SME managers in Awka South Local Government area, Anambra State

S/N	ONLINE ADVERTISING	Mean	SD	Remark
15	Online advertising helps in increasing sales online revenue	3.94	.99	SA
16	Online advertising helps to understand your target audience	3.83	.95	SA
17	Online advertising helps in focusing on customer service.	3.73	.88	SA
18	It helps to provide a chat feature on your website	3.71	.94	SA
19	Online advertising helps to showcase your products with high-quality photo	3.93	.92	SA
20	It helps to find your unique selling proposition	3.59	1.03	SA
21	Online advertising helps in creating your business content	3.85	.91	SA
CLUSTER MEAN		3.79	0.95	SA

Table 3 shows that all the seven-aspect depicting the quality of SMEs have mean ratings ranging from 3.5 to 3.9, which shows that the respondents agreed with the extent of utilizing online advertising tools for sales improvement by SMEs involved in increasing sales online revenue, understanding the target audience, focus on customer services, provide chat feature on the website, showcase the product with high-quality photo and creating business content. The cluster mean of 3.79 shows that the extent of quality assurance in utilizing online advertising for sales improvement was highly extent. The standard deviation score for all the items is within the same range.

Discussion

The findings of this study revealed that SME managers in Abuja Federal Capital Territory (FCT), perceived the benefits of social media network to a great extent. This is encouraging because out of five items, one was rated very great extent, three items were rated to a great extent and the remaining one was rated low extent in disagreement with the negative items against the benefit of online learning shows that the most of the managers maintained that social media network is of great benefit. This is shown by a cluster mean score of 3.19 which is within the great extent (2.50-3.49) category. Findings of this study concur with that of (NOUN, 2023), social media network currently, has become a significant platform for education, stating that individuals who missed out

on school can enrol for online and distance learning (ODL) to improve their interpersonal skills and enhance their adaptability to new technologies.

The findings of the study regarding the second research question showed that SME managers in Abuja FCT, considers five out of seven factors that hinder one's enrolment in social media network to a great extent, while the remaining two items was considered a hindrance to one's enrolment to a low extent. The study revealed that negative attitude from family members and not having an android phone constitute hindrance to one's social media network enrolment but to a low extent. This is because almost every youth make use of android phones especially for business transactions, coupled that with determination, family members attitude could be overcome. The findings of this study are in line with the findings of Aigbedion, et al (2018) that revealed the challenges of SMEs in Awka South Local Government area, Anambra State to include inadequate finance and poor access to credit facilities among others. Also, the assertion of Zhu et al. (2020), maintained that lack of access to reliable technology and the internet is a significant challenge for many potential online learners, making it difficult for them to enroll. Some online programs are more cost-effective, tuition fees can still be a barrier, especially for low-income students. Additionally, not all online programs offer the same level of financial aid or scholarships as traditional programs. Castro and George (2020) in support of the above stated that lack of financial support can deter potential students from enrolling, as they may not be able to cover the costs out-of-pocket.

The findings of the study regarding the third research question showed that the extent to which social media network contributes to self-achievement was rated to a great extent by the SME managers in Abuja FCT. The study revealed that all the items on this section contributes to self-development as perceived by the managers. According to a study by Kauffman (2020), social media network environments encourage learners to take greater responsibility for their learning outcomes, which in turn leads to higher levels of self-achievement. In support of the above statement, Broadbent and Poon (2015) posited that the flexibility and accessibility nature of social media network platforms allow individuals to balance education with other life responsibilities, leading to a sense of personal accomplishment as they meet their learning goals at their own pace. Therefore, it's of great importance and advantage for the SME managers to queue into the social media network programmes as an avenue to increase their self-worth and obtain self-achievement as posited by Njoku et al., (2022), that policy should be formulated towards educating and training SME owners to have more knowledge about business enterprise operation to be able to assess their financial performance.

The findings of the study regarding the fourth research question showed that the extent to which social media network contributes to self-development was rated to a great extent by the SME managers in Abuja FCT. The study revealed that all the items on this section contributes to self-development by the perception of the SME managers. This agrees with the assertion of Cacciolatti et al. (2020), which states that social media network enables entrepreneurs to acquire practical knowledge. Moreover, research by Yu and Hu (2021) suggests that social media network environments provide entrepreneurs with opportunities to engage in continuous learning, allowing them to stay updated with the latest industry trends and technological advancements. This continuous professional development is essential for navigating the complexities of the modern business environment. That is to say that social media network significantly contributes to the self-development of entrepreneurs by offering them flexible access to a wealth of knowledge and skills tailored to their specific business needs (Cacciolatti et al, 2020). Through online platforms, SME managers can enhance their competencies in areas such as business strategy, financial management, and marketing, which are crucial for the growth and sustainability of their

enterprises. Mansoori and Lackéus (2020) equally supports this study by positing that social media network facilitates entrepreneurial self-development by offering resources that foster critical thinking, innovation, and problem-solving skills that are crucial for navigating the complexities of entrepreneurship and achieving business success.

Conclusion

The findings of this study emphasized the significant positive perception SME managers in Abuja FCT have toward the benefits of social media network, particularly in terms of its contribution to self-achievement and self-development. The study reveals that most managers recognize the value of social media network, as evidenced by the high ratings across multiple items related to its benefits. This suggests a growing awareness and appreciation for the role that online education plays in enhancing entrepreneurial skills and knowledge, which are crucial for business success, especially in a dynamic and uncertain economic environment.

Moreover, despite some identified barriers to enrolment in social media network such as negative attitudes from family members and limited access to technology the overall perception remains favourable. The minimal impact of these barriers suggests that with proper motivation and access to resources, SME managers are likely to overcome such challenges. The study also highlights the importance of social media network in fostering continuous professional development, which is essential for staying competitive in today's market. The ability of online platforms to provide flexible, accessible, and practical learning opportunities is instrumental in helping SME managers in Abuja FCT improve their competencies, ultimately contributing to the sustainability and growth of their enterprises.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. The government or private sector initiatives should help to provide affordable internet access and digital devices to SME managers. It is important to improve access to reliable technology and internet services to ensure that SME managers can fully benefit from social media network opportunities.
2. Initiatives should be undertaken to educate families and communities through creation of awareness about the value of social media network. This can help mitigate negative attitudes and encourage more SME managers to enroll in online programs, thereby fostering an environment supportive of continuous learning.
3. The government and NGO initiatives should provide scholarships, grants, and low-interest loans to SME managers to address financial barriers associated with social media network. This would enable more entrepreneurs to afford the costs associated with online education, and encourage more enrolment.
4. Educational institutions and social media network platforms should create courses specifically designed for SMEs, focusing on practical business skills such as financial management, marketing, and strategic planning. These tailored programs can better meet the needs of entrepreneurs, facilitating their professional development and the growth of their businesses.
5. More universities, polytechnic, colleges of education and even secondary schools should be advised to apply for a license to operate dual-mode programs where social media network

will be incorporated for the benefit of these groups of people as practised in some other countries like India.

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WORK-LIFE BALANCE OF FEMALE UNIVERSITY ACADEMICS IN SOUTH-WESTERN NIGERIA

Motunrayo Ajoke Adeosun, Olubunmi Ajoke Aloba & Ronke Christiana Ojo

Department of Adult Education

University of Lagos

08025082144

Abstract

The global increase in women's participation in the workforce has significantly altered family dynamics, reshaping the roles women play within family structures. However, striking this balance is pivotal for overall well-being and sustainable career growth of female university academics. In this context, the study investigated work-life balance of female university academics in South Western Nigeria. The study is underpinned by Gender Role and Spillover theories. Four research questions and corresponding hypotheses were raised and tested. The study adopted the descriptive survey research design. The population of the study consisted of 5,810 female university academics in South Western Nigeria. Simple random sampling technique was used to select 512 married female university academics from the selected universities in South Western Nigeria. The internal consistency reliability index of the instrument was validated and recorded $r = .887$ reliability co-efficient. The quantitative data were analysed using the Scientific package for social sciences (SPSS) Version 23. The hypotheses were tested at 0.05 level of significance using Pearson Product Moment Correlation Coefficient (PPMCC). The study reveals that female university academics adeptly employ family social support, household assistance, flexible work schedules, and organisational childcare support as coping strategies to navigate stress and challenges. In light of the findings, the study recommends that support systems are needed to enhance the work-life balance of female university academics. This in essence, would enable them to perform well both in their careers and families.

Keywords: Academics, Balance, Female, Universities, Work-Life.

Introduction

Educational institutions face quite a number of challenges, which include heightened competition, encumbering academic activities and environmental complexities. However, the challenges associated with employees, particularly those within universities, whose roles are crucial to ensuring effective knowledge production, dissemination and community service. These academic staff members are tasked with maintaining optimal performance to fulfil work role while also tending to their family duties. The academic roles of lecturing, setting examination questions, marking examination scripts, attending to students as course advisers, engaging in research works, supervising undergraduate and postgraduate students, performing community service within and outside the university, can be overwhelming for individual employee when combined with family obligations such as childcare, spousal care, care of the elderly parents, or family members with special needs, domestic relations issues with, maintenance of social relationships or even routine household maintenance activities frequently impinge employees' attention and performance while on the job (Leaptrott & Mcdonald, 2011). This overlap often leads to extended work hours, encroaching significantly upon family responsibilities (Kuther, 2015).

The role expectations of these two domains are not often incompatible, creating conflicts between work and family life. These conflicts are related to outcomes such as job dissatisfaction,

resignations, reduced work productivity, heightened absenteeism, and low turnover rates, as well as outcomes related to psychological distress (such as depression) with resultant negative impact on job performance in the workplace.

Work can be a very satisfying experience for people, yet work sometimes affects other aspects of our lives in ways that are problematic (Oludayo, 2015). Work-family conflict results when the needs of the family and the needs of the workplace cannot both be met, because the time and effort required by one of these roles makes it difficult to fulfill the other (Barnett & Hyde, 2001). This is why striking balance and maintaining harmony between work and family have always been a great challenge for women in general because they bear the consequences of the need to combine work and family roles. Work-family conflict according to Oludayo, 2015 is a global assessment on how work resources does not meet family demands and how family resources does not meet work demands such that participation is not effective in both domains. This shows that work-family conflict occurs when the demands of work are in disharmony with the demands of family life.

These conflicts, if unaddressed, will greatly undermine the level of job performance in the workplace and the level of family happiness for the concerned employees because there are contradictory role expectations that a typical career woman experienced, while she is at work and at home. On the professional front she is expected to be committed, dynamic, competitive, straight forward and non-sentimental, act in a “business like” manner, and then at home, she is expected to be sweet, soft, sensitive, adaptable, gentle and unassertive, and domesticated. Therefore, women that assume multiple roles result in work-family conflict because time and energy are shared across the two spheres of activity. Therefore, coping with the situation requires not only additional physical strength, personal ability and intelligence on the part of working women but also requires both family members assistance and organisational supports (Such as: husband, parents, siblings, relatives and the employer) to simultaneously make necessary modifications in their expectations.

Balancing responsibilities between work and family is an ongoing struggle for many employees, often causing them to prioritise one role over the other due to the inability to meet both demands harmoniously (Vasumathi, 2018). This struggle continues because as women continue to engage in paid employment in order to provide sufficient resources for their families, they also engage in taking care of young children and family; that is why achieving work-family balance is not an easy task at all. This has compelled many women to leave their jobs as they do not have child care facilities at work. However, striking a balance between work role and family role in order to have effective and efficient performance from the employees in the institution is germane. Work-family balance is defined as the extent to which an individual is happy and experiences a satisfactory equilibrium between their work and family roles (Ajala, 2016). In essence, work-life balance implies an individual's perception of effectively managing multiple life domains—personal time, family care, and work with minimal role conflict (Clark, 2000 as cited in Delina & Raya, 2013). The ability to meet work and family commitments, along with non-work responsibilities and activities, defines one's work-life balance (Delecta, 2011). This encapsulates four critical domains: work, family, self and other activities.

The confluence of work-life balance emerged as a concern, particularly for married women, as their engagement in the formal employment sector increased over time. Multiple reasons drive the increase in women participation in the formal sector, including elevating household standards of living, improved female education levels, and meeting a country's employment demands. Married and employed women, when they become mothers, have to manage children, manage the house chores and continue on their career path. This means that working mothers of today have to fulfil family responsibilities and also have to remain fully involved in their careers. Successfully

managing both family responsibilities and career pursuits becomes an arduous challenge for married women. This necessitates coping with the conflicting demands of their various roles (Delina & Raya, 2013).

Achieving a balance between work and family roles has always presented a significant challenge for women in academics. A balanced approach to professional, maternal and household responsibilities is essential for effective performance. Since it is a must that women in academics do research to keep their jobs like their men counterpart, they have to juggle career needs and family responsibilities in order to have a work-life balance. Thus, it is crucial for academic institutions to be able to provide support systems to assist female university academics in coping with their multiple roles. The consequential effect would be that women with work-life balance will perform well both in their career and would produce healthy and happy families. This also would encourage happy and productive working women. Consequently, organisations striving to optimise employee performance should establish supportive systems that ensure staff members enjoy a healthy work-life balance. Therefore, the issue of balancing work-family role has been identified as a major problem facing female academic staff, and it has garnered increased attention in order to help female university academics enjoy work-life balance.

Statement of the Problem

The global increase in women's participation in the workforce has significantly altered family dynamics, reshaping the roles women play within family structures, whether nuclear or extended. In contemporary society, women no longer solely fulfil the traditional roles of homemakers; they have become significant contributors to household income, shouldering the responsibility of providing for the family. As more women engage in formal employment, the challenge of work-life balance and work-life conflict has gained prominence, especially for female university academics. These challenges stem from various factors, including the need to enhance household standards of living, and improved educational opportunities.

The academic roles of lecturing, setting examination questions, marking examination scripts, attending to students as course advisers, engaging in research works, supervising undergraduate and postgraduate students, performing community service within and outside the university, can be overwhelming for female university academics when combined with family obligations such as childcare, spousal care, and overall family support. Balancing both work and family role has always been a great challenge for female university academics because they bear the consequences of the need to combine work and family role and if it is not properly managed, it tends to result in unpleasant consequences such as increased divorce rate, untimely death, decreased marital satisfaction, resignation from jobs, decreased work productivity, increased absenteeism, and lower standard of work performance among others.

Social support from family members especially from spouse, siblings, grandparents and relatives can influence social well-being among female university academics because social well-being is an indicator of a responsible lifestyle. This means that people with high level of social well-being are reported to feel happy, capable, well-supported, and satisfied with life. However, if this social support is lacking in a household, it will eventually result in work-family conflict. Additionally, the organisational childcare support contributes to the outcome of the performance of female university academics, such that the child care facilities must be conducive enough and be friendly, this will help mothers to be sure of the safety of their children and it will eventually lead to increase productivity in the academic institutions. However, these support systems are not adequately provided for female university academics, and this can lead to decrease in productivity. Hence, ability of female university academics to maintain balance between their jobs and lives is one way

by which they can increase performance at work. Recognising and addressing these challenges is essential to fostering a more conducive environment for female university academics, enabling them to achieve a healthier work-life balance. Therefore, this research work is carried out to examine work-life balance of female university academics in South Western Nigeria.

Purpose of the Study

The main purpose of this study is to examine the work-life balance of female university academics in South Western Nigeria. Specifically, the study seeks to:

- i. Examine family social support and its impact on work-life balance among female university academics in South Western Nigeria;
- ii. Identify the relationship between house assistance and work-life balance among female university academics in South Western Nigeria;
- iii. Explore the relationship between flexible work schedules and work-life balance among female university academics in South Western Nigeria; and
- iv. Ascertain the relationship between organisational child care support and work-life balance among female university academics in South Western Nigeria.

Research Questions

The following research questions were formulated to guide the study:

- i. How does family social support enhance work-life balance among female university academics in South Western Nigeria?
- ii. In what way does house assistance improve work-life balance among female university academics in South Western Nigeria?
- iii. How does a flexible work schedule contribute to work-life balance among female university academics in South Western Nigeria?
- iv. What way does organisational child care support work-life balance among female university academics in South Western Nigeria?

Research Hypotheses

The following hypotheses were postulated and tested:

- i. There is no significant relationship between family social support and work-life balance among female university academics in South Western Nigeria.
- ii. There is no significant relationship between house assistance and work-life balance among female university academics in South Western Nigeria.
- iii. There is no significant relationship between a flexible work schedule and work-life balance among female university academics in South Western Nigeria.
- iv. There is no significant relationship between organisational child care support and work-life balance among female university academics in South Western Nigeria.

Research Methodology

A descriptive survey research design was adopted in this study. This design was chosen due to its efficacy in systematically gathering information from a relatively large population. The design was deemed appropriate as it facilitated a comprehensive understanding of the issues associated with the work-life balance of female university academics in South-Western Nigeria. The research was conducted in South-Western Nigeria, encompassing six states. This choice was driven by the region's distinction as having the highest number of universities in Nigeria and its unique nature, characterised by geographical, cultural, ethnic, and historical similarities. The population of the study comprised 5,810 female university academics in both public and private universities across South Western Nigeria. This region hosts a total of 54 universities, consisting of 7 federal, 11 state, and 36 private universities (NUC, 2019).

The sample size for this study was 512 married female university academics in selected public and private universities in South-Western Nigeria. Multi-stage sampling procedure was adopted for the selection. In order to examine work-life balance of female university academics, data were collected using self- structured questionnaire titled “Work-Life Balance of Female University Academics Questionnaire (WLBFUAQ). The drafted questionnaire was given to the researcher’s supervisors and other two experts in Measurements and Evaluation for content validity. The split-half method was used to ascertain the reliability of the instrument. The researcher administered 40 copies of the questionnaire to female university academics in University of Lagos. The researcher then collated the results of the questionnaire and used Cronbach Alpha to test the reliability at 0.05 level of significance. The quantitative data obtained from the questionnaire were analysed using the Statistical Package for Social Sciences (SPSS) Version 23; and were presented in percentages while Pearson Product Moment Correlation Coefficient (PPMCC) at 0.05 significance level was employed for testing the hypotheses.

Results

Hypothesis One: There is no significant relationship between family social support and work-life balance among female university academics in South-Western Nigeria. The hypothesis was tested using Pearson Product Moment Correlation Coefficient and the summary of the results presented in the table 4.2.1

Table 4.2.1: Relationship between family social support and work-family balance

				Std	rCal	P-	Remarks
Decision		N	Mean	Dev.	Value		
Family social support	500	2.44	.439				Null Hypothesis Rejected
					.500*	.000	Significant
Work-family balance	500	2.560	.479				

**Correlation is significant at $p < 0.05$ level (2-tailed).*

Findings of the study indicate that there is a weak, but positive correlation between the two variables ($r = .500$, $n = 500$, $p < 0.05$), with high levels of use of family social support associated with work-family balance among female academic staff in South-West Universities. This implies that the more academic staff members use family social support strategy to manage their stress the better they are able to overcome work-family conflict. Thus the null hypothesis that says there is no significant relationship between the use of family social support and work family balance among academic staff in South Western Universities was rejected and the alternative accepted.

Hypothesis Two: Usage of house assistance does not have significant relationship with work-life balance among female university academics in South Western Nigeria. The hypothesis was tested using Pearson Product Moment Correlation Coefficient and the summary of the results presented in the table 4.2.2

Table 4.2.2: Relationship between the use of house assistance and work-family balance

	N	Mean	Std Dev.	rCal	P- Value	Remarks	Decision
Use of House assistance	500	2.703	.479				Null
		*.334	.000			Significant	
Work-family balance	500	2.560	.553				Hyp

**Correlation is significant at $p < 0.05$ level (2-tailed).*

Findings of the study indicate that there is a weak, but positive correlation between the two variables ($r = .334$, $n = 500$, $p < 0.05$), with high levels of house assistance associated with work-family conflict among academic staff of South Western Universities. This implies that the more the academic staff use house assistance strategy to manage their stress the better they able to overcome work-family conflict. Thus the null hypothesis that says there is no significant relationship between the use of house assistance and work-family balance among academic staff in South-Western, Nigeria was rejected and the alternative accepted

Hypothesis Three: There is no significant relationship between flexible work schedule and work-life balance among female university academics in South-Western Nigeria. The hypothesis was tested using Pearson Product Moment Correlation Coefficient and the summary of the results presented in the table 4.2.3

Table 4.2.3 Relationship between flexible work schedule and work-family balance

	N	Mean	Std Dev.	rCal	P- Value	Remarks	Decision
Flexible work schedule	500	3.560	.479				Null
				.497*	.000	Significant	
Work-family balance	500	2.522	.504				Hypothesis Rejected

**Correlation is significant at $p < 0.05$ level (2-tailed).*

Findings from the study indicate that there is a fairly strong, but positive correlation between the two variables ($r = .497$, $n = 500$, $p < 0.05$) with application of flexible work schedule as a coping strategy associated with work family balance of female academic staff. This implies that the more female academic staff members utilise flexible work schedule of the university as a coping strategy to manage their stress/challenges the better they are able to resolve their work-family conflict. Thus the null hypothesis that says the use of flexible work schedule as a coping strategy will not significantly influence work-family conflict of female academic staff, Nigeria was rejected.

Hypothesis Four: There is no significant relationship between organisational childcare support and work-life balance among female university academics in South Western Nigeria. The hypothesis was tested using Pearson Product Moment Correlation and the summary of the results presented in the table 4.2.4

Table 4.2.4 Relationship between organisational child care support and family balance

	N	Std Dev.	rCal	P- Value	Remarks	Decision
Mean						
Child care support	500	2.754	.491			Null
			.497*	.000	Significant	Hypothesis
Work-family balance	500	2.560	.479			Rejected

**Correlation is significant at $p < 0.05$ level (2-tailed).*

Findings from the study indicate that there is a fairly strong, but positive correlation between the two variables ($r = .497$, $n = 500$, $p < 0.05$), with the use of organisational child care support as a coping strategy associated with work-family balance. This implies that the more female academic staff members use organisational child care support as a coping strategy to manage their stress/challenges, the better their work-family conflict reduced. Thus the null hypothesis that says there is no relationship between the uses of organisational childcare support and work family balance among female academic staff of Nigerian Universities was rejected.

Discussion of Findings

First, findings revealed that family social support helped to reduce stress among female academic staff members. This finding aligns with the report by Afrianty, Burgess and Issa (2015) who say family social support is a dimensional construct that may be defined as the comfort, assistance, or information one receives through informal social contacts. They also indicated that persons with high levels of family support experience fewer psychological symptoms and appear to be less affected by life stress than persons with lower levels of family support. Hence, social supports from families are important in helping the academic staff members who are also wives and mothers at home to balance their responsibilities between work and family and also to reduce stress.

Second, findings on the usage of house assistance as a coping strategy helped female academic staff to effectively manage their work and family role. This is in support of Lyonette and Baldauf (2019) according to their opinion that house assistance can reduce considerably the percentage of lateness to work, absenteeism, stress, work-family conflict and further increase job satisfaction, productivity and organisational commitment among employees, thereby improving the overall performance and growth of the organisation.

Third, findings on the flexible work schedule helped to resolve work-life conflict. This practice can reduce the tiredness and absenteeism, increase staff morale, job satisfaction and ultimately staff performance. This finding also supports Bakare (2013) on his assertion that flexible work schedule among working mothers has no detrimental effect on employees. This will help female academic staff to balance both work and family role effectively.

Finally, findings revealed that organisational child care support enhanced work-life balance among female academic staff members. This implies that the more female academic staff members use organisational childcare support as a coping strategy to manage their stress/challenges, the better they balance their work-family roles. Ogunyemi, Adenuga and Lawal (2019) asserted that such measures may help reduce work-family conflict by providing childcare facilities or assistance. It was emphasised that most of the environment of the crèche should be conducive enough or safe for the children. This is because of the rate at which women increasingly combining

employment and childcare responsibilities, this shows they need a modern workplace childcare centre which is friendly for the children to stay and will afford them easy access to work. Putting in place work and family support policies in this regard would go a long way in alleviating and cushioning their work-family conflicts.

Conclusion

The findings corroborate previous research indicating that family social support is fundamental in reducing stress levels among academic staff members. High levels of family support contribute to fewer psychological symptoms and less vulnerability to life stress. This underscores the need to promote family support systems to help academic staff, who are often also wives and mothers, balance their responsibilities between work and family. Similarly, the positive impact of house assistance as a coping strategy aligns with research indicating its potential to reduce lateness, absenteeism, stress, and work-family conflict while enhancing job satisfaction and productivity. Flexible work schedules were also found to be effective in alleviating work-life conflicts, supporting previous studies. Lastly, organisational child care support was identified as a crucial element in achieving work-life balance, aligning with research emphasizing the need for conducive and safe child care environments.

In a nutshell, the study emphasises the crucial role of family social support, house assistance, flexible work schedules, and organisational child care support in promoting work-life balance among female academic staff members. Recommendations are provided to encourage the development of work-life balance programs, enhance family support systems, and improve child care facilities. The study also contributes to knowledge by establishing a conceptual framework and providing coping strategies to strengthen stress resilience and achieve work-life balance.

Recommendations

Based on the findings and conclusions, the following recommendations are proposed:

1. Establishment of work-life balance programs, workshops, and seminars in partnership with adult educators.
2. Commitment from university management and family members to provide effective work-family support systems.
3. Exploration of employer-sponsored and subsidized child care services, along with the creation of reputable and affordable child care facilities.
4. Encouragement for spouses, siblings, parents, and relatives to contribute to childcare responsibilities for proper upbringing.
5. Increased involvement of university management in supporting the well-being of female university academics.
6. Reorientation for men to align with current realities and move away from traditional gender roles.

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ACADEMIC INTEREST AS PREDICTOR OF SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN ENGLISH LANGUAGE IN ANAMBRA STATE

Nneka Anthonia Obumse, Ph.D.

Department of Educational Foundations,
Faculty of Education
Chukwuemeka Odumegwu Ojukwu University
Igbariam campus.
ladyneka101obumse@gmail.com

Abstract

The purpose of the study was to determine the predictive value of academic interest on academic achievement of secondary school students' in English Language in Anambra State. One research question guided the study and one null hypothesis was tested at 0.05 level of significance. The study was carried out using a correlational research design. It was conducted in Anambra State which is made up of six educational zones namely: Onitsha, Otuocha, Awka, Ogidi, Aguata and Ihiala educational zones. Out of these education zones, the Awka Education Zone was selected for the study. The Awka Education Zone has a total population of 3,890 SSSII students. The population of male SSSII students is 1,692 while the population of SSSII female students is 2,198. The sample of the study consisted of 300 senior secondary school students (SSII) drawn from the students' population in the zone. Stratified sampling technique was used to select subjects for this study. Simple random sampling technique was used in selecting Awka Education zone from the six education zones in Anambra State and selection of two secondary schools each from each stratum (Local Government Area) where this study was carried out. This brings the total number of schools for the study to six (6) schools. In stage two, simple random was used to get 50 students per school. This brought the total target sample size for the study to 300 students. The instruments for data collection were two questionnaires developed by the researcher. The first instrument was titled: "Academic Achievement Questionnaire (ACAQ)". The second instrument is titled "Academic Interest Questionnaire (AIQ)". Both instruments were structured on the four-point scale of Strongly Agree (SA); Agree (A); Disagree (D); and Strongly Disagree (SD). The face and content validity of the instruments were ascertained. Using the Cronbach Alpha reliability coefficient, the reliability coefficients of 0.95 and 0.82 were obtained for ACAQ and AIQ respectively. The questionnaires were administered by the researcher with the aid of two research assistants. The Pearson Product Moment Correlation was used to answer the research question while regression analysis was to test the null hypothesis. Findings indicated that academic interest has low and positive predictive value on academic achievement of secondary school students in secondary schools in English Language in Anambra State, and that academic interest significantly predicted academic achievement of secondary school students in secondary schools in English Language in Anambra State. Among others recommended, it was suggested that teachers should use lesson delivery strategies that will enhance academic interest of the students in order to increase the academic achievement of secondary school students since an increase in academic interest can lead to increase in academic achievement of secondary school students.

Keywords: Predictive Value; Academic Interest; Academic Achievement; English Language.

Introduction

The importance of interest in whatever a person does cannot be underestimated. In education as in other aspects of human life, when it comes to making choice, interest is of considerable importance. There are basically two forms of interest, namely, individual (or personal) and situational interest. Of course, a student or learner can approach a learning situation with or without interest. Individual interest is a relatively enduring predisposition to attend to certain objects and activities, and it associates with positive effect, persistence and learning. People working with individual interests are motivated learners. Their activity appears purposeful, sustained, and ever deepening. They do not really need to make a choice to learn subject matter that is of individual interest to them. Situational interest on the other hand, refers to an interest that people acquired by participating in an environment or context. In this study, therefore, interest is linked to the student in relation to school.

The past years have witnessed the evolution of research pertaining to interest. Several studies concerned with the effect of interest factors on academic achievement in secondary schools have yielded positive result. Interest is defined by Typhoon International Corp. (2004) as the attention with a sense of concern; lively sympathy or curiosity; and the power to excite or hold such attention (in something). Interest plays great role in the field of psychology as some recent research works have found that it is closely related with personality, motivation, cognition, development, emotion, vocations, aesthetics, behaviour, hobbies, reasoning, and information processing (Silvia, 2006). A few works have found interest to be a factor that partly influences reading and text processing as a text with the features of coherence, vividness, ease of comprehension, and concreteness tends to arouse greater interest of the audience than a text without such features. Though there is evidence that seductive details of interest have detrimental effect, as it impairs comprehension, interest nevertheless promotes comprehension and memory for several reasons: interest increases attention to a text; interest makes people process a text more deeply; and interest promotes good meta-cognitive strategies (Silvia, 2006).

In an observation by Tella et al. (2011) interest leads to a mastery goal orientation when learners are motivated by interest. Learners are motivated by intrinsic reward when they recognize that, in the pursuit of an interest, they will be drawn to master the knowledge skills, not just to demonstrate them. Following the theoretical framework which proposed that interest is considered a person-object relation that is characterized by the value commitment and positive emotional valences. Interest driven activities are characterized by the experience of competence and personal control, feelings of autonomy and self-determination, positive emotional states under optimal circumstances, an experience of flow whereby the person and the object of interest coincide. The overall correlation between interest and academic achievement was about however this relation was heterogeneous across different school subjects and indicators of achievement.

Since most studies in this area of research are cross sectional and correlations, Tella et al. (2011) concluded that. Firstly, most of the cognitive ability and level of prior achievement or knowledge were not included as additional predictor variable. Consequently, one cannot say precisely whether interest predicts achievement. Secondly, most of these studies were correlational in nature and thus do not allow causal conclusion. Findings on empirical relations between interest, learning and achievement have also indicated that interest-based motivation has favorable effects on both the process and the outcome of learning.

In spite of psychologist's praxis that is mainly on determination of why people do what they do, psychologists have typically disregarded close examination of interest as an important construct in determining learning, motivation and emotion (Silvia, 2006). Recently, psychologists have

started to investigate interest and the results are impressive. According to Paul (2014) who stated that in recent year researchers have begun to build a science of interest, investigating what interest is, how interest develops, what makes things interesting, and how we can cultivate interest in ourselves and in others. They are findings which revealed that interest can help us think more clearly, understand more deeply, and remember more accurately. Interest has the power to transform struggling performers, and lift high achievers to a new plane. In an earlier study, Paul (2014) found that interest cognitively engages students and statistically fosters learning. Interest could be seen as a psychological state of engagement, experienced in the moment, and also a predisposition to engage repeatedly in particular ideas, events, or objects over time (Paul, 2014).

Interest simultaneously diversifies ones' experience and focuses his experience; leading him to pay attention to only certain things and not to some other things that tend to stimulate the persons' attention. Interest serves as a drive towards the new, the edgy, and the exotic. Both the urge to approach or engage in certain events and the urge to avoid some events lie in the realm of interest. Interest in an activity, such as learning, could most probably be a very powerful affective psychological trait and a very strong knowledge emotion as well as an overwhelming magnetic positive feeling, a sense of being captivated, enthralled, invigorated and energized to cognitively process information much faster and more accurately in addition to most effective application of psychomotor traits like self-regulatory skills, self-discipline, working harder and smarter with optimum persistence (Kpolovie, 2010).

Persistence for instance, is defined by Kpolovie (2012) as the indomitable willpower, unshakable determination, irrepressible commitment, absolute dedication, relentless pursuit, continuous and ever-increasing confidence and resolute action in the direction of one's goal until it is satisfactorily achieved. Self-discipline is defined as the ability to and the actual commitment to make oneself do what one should do, exactly how and when he/she should do it, irrespective of whether he/she feels like it or not (Kpolovie, 2010). It is little wonder then that when an individual is keenly interested in the information that he is learning, he tends to pay closer attention; process the information more effectively; employ the most effective learning strategies; engage in critical thinking; rehearse deeply; and very frequently make connections between the new information and old knowledge acquired (Kpolovie, 2012). Growing knowledge leads to growing interest as new information increases the likelihood of conflict (that is, conflict of coming across a fact or idea that does not fit into what the individual has already learnt) (Paul, 2014). The more a person knows or learns about a domain, the more interesting the domain becomes to him. This is most probably because of the phenomenon of more learning leading to more questions, which in turn increases learning.

In view of the above assertions, Kpolovie (2012) emphatically posited that: The most central phenomenon in human life can rightly be said to be learning. The desire to express learning and to acquire more of it both consciously and unconsciously is infinitely endless. No individual has learnt maximally and none perhaps, could ever do so; yet to maximally learn in a perfectly unforgettable manner is doubtlessly the ultimate goal of all human. According to Kpolovie, leaning is the complex synergy of cognitive, affective, psychomotor and environmental experiences and other influences for the acquisition, maintenance, organization, reorganization and enhancement of changes in an individuals' behavior, knowledge, skills, values, personality and world views for better resolution of problems. Each problem so resolved, is itself a relevant piece of leaning that adds to the complex whole and better prepares the individual for further acquisition and organization of knowledge to produce yet a more intelligent behavior in overt or covert problem resolution. The information that is novel, complex, and comprehensible tends to arouse learners' interest because it increases curiosity.

Understanding of the learning material is crucial in capturing of the learners' interest. New and complex things are interesting provided the learner feels able to comprehend them and master the challenges that they pose (Paul, 2014). Curiosity is the totality of a persons organized active explorative and manipulative behavior in response to the occurrence of a novel, unexpected and unpredicted phenomenon by logically seeking conclusive observable and empirical evidence to resolve all the questions of what, why, how, when and which about the phenomenon (Kpolovie, 2010). The curious individual is (intrinsically) motivated to obtain the missing information to reduce or eliminate the feeling of deprivation. Once this is done, the individual has learnt both the information that led to the curiosity or knowledge gap as well as the information with which he filled the knowledge gap or resolved the curiosity. So, learning could be facilitated by creating or arousing the learners' interest with catching and holding his attention via presentation of novel, complex and comprehensible information that arouses his curiosity (Kpolovie, 2010). While catching the learners' interest is about seizing his attention by providing highly stimulating information, holding his interest is about finding deeper meaning and purpose in the exercise of interest. Sustaining of a person interest in a piece of information could also be done by promoting the development of his interests by supporting his feelings of competence and self-efficacy, self-direction and autonomy that makes him to sustain the attention and motivation even in the midst of challenging or confusing material. Interests powerfully influence academic and professional choices.

In the present dispensation, there is no problem more perplexing or frustrating than the situation in which a bright child cannot or will not perform at an academic level commensurate with his or her intellectual ability. The gifted child who is an academic underachiever may suffer from more than poor grades and the disapproval of parents and teachers. Unfortunately, if performance in school is deemed inadequate, the child may also perceive himself or herself as inadequate in other kinds of learning experiences. As these unpleasant experiences continue, a negative attitude toward school, self, and learning in general may result, and poor motivation habits may develop. The explanation and prediction of academic achievement is an important area of research in education. The prevalence of research efforts in this area reflects the fact that many decisions reached in the modern educational system are based upon predictions of school success. The estimation of a candidate's probability of future academic success is a central aspect of the decision-making process in every educational setting, irrespective of whether the process involves personal decisions or institutional decisions (Ololube & Kpolovie, 2012). There are three major distinct groups of factors that have been found by psychologists to influence achievement (a) student characteristics (e.g., intelligence), (b) home environment (e.g., socioeconomic class), and (c) school context (e.g., quality of instruction). Academic career decisions rely mainly on student characteristics that are broadly classified into three factors of academic success prognosis: (a) general cognitive factors such as verbal and quantitative ability; (b) general motivational factors like achievement motivation; and (c) specific preferences for particular subject areas. The last two of these factors can commonly be referred to as interests (Krapp, Schiefele & Winteler, 2009). In view of this, the aim of the study was to determine the predictive value of academic interest on academic achievement of secondary school students' academic achievement in English Language in Anambra State.

Research Question

The following research question guided the study.

What is the predictive value of academic interest on academic achievement of secondary school students in English Language in Anambra State?

Hypothesis

The following null hypothesis was tested at 0.05 level of significance.

1. There is no significant prediction between academic interest and academic achievement of secondary school students in English Language in Anambra State.

Research Method

The study was carried out using correlational research design. It was conducted in Anambra State which is made up of six educational zones namely: Onitsha, Otuocha, Awka, Ogidi, Aguata and Ihiala educational zones. Out of these education zones, the Awka Education Zone was selected for the study. The Awka Education Zone has a total population of 3,890 SSSII students. The population of male SSSII students is 1,692 while the population of SSSII female students is 2,198 (P.P.S.S.C. Headquarters, Awka, 2024). The sample of the study consisted of 300 senior secondary school students (SSII) drawn from the students' population in the zone. Stratified sampling technique was used to select subjects for this study. Simple random sampling technique was used in selecting Awka Education zone from the six education zones in Anambra State and selection of two secondary schools each from each stratum (Local Government Area) where this study was carried out. This brings the total number of schools for the study to six (6) schools. In stage two, simple random samplings was used to get 50 students per school. This brought the total target sample size for the study to 300 students. The instruments for data collection were two questionnaires developed by the researcher. The first instrument was titled: "Academic Achievement Questionnaire (ACAQ)". The second instrument is titled "Academic Interest Questionnaire (AIQ)". Both instruments were structured on the four-point scale: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The face and content validity of the instruments were ascertained by giving copies of it to two experts in the Faculty of Education, Nnamdi Azikiwe University Awka. Using the Cronbach Alpha reliability coefficient, the reliability coefficients of 0.95 and 0.82 were found for ACAQ and AIQ respectively and they are high thereby making the instruments reliable. The questionnaires were administered by the researcher with the aid of two research assistants and was through direct contact, and completed copies were collected on the spot. Arrangements on how to collect from those who could not complete their own immediately were made. The Pearson Product Moment Correlation was used to answer the research question while regression analysis was to determine the r^2 and adjusted r^2 . The co-efficient "r" obtained was used to ascertain how each of the independent variables predicted the dependent variable.

Following Best and Khan (2006), the research questions were interpreted using the real limit of numbers of:

0.01	-	0.39	weak prediction
0.40	-	0.59	Moderate prediction
0.60	-	0.99	Strong prediction

In interpreting the values of the null hypothesis, when p-value was less than or equal to 0.05 ($p \leq 0.05$), the null hypothesis was rejected. On the other hand, when the p-value was greater than 0.05 ($p > 0.05$), the null hypothesis was not rejected.

Result and Discussion

Research Question One: What is the predictive value of academic interest on academic achievement of secondary school students in secondary schools in English Language in Anambra State?

Table 1: Pearson's Correlation Analysis of the predictive value of academic interest on academic achievement of secondary school students in English Language in Anambra State

Variables	N	Academic interest	Academic Achievement	Remark
Academic Interest	1, 500	1	.221	
Academic Achievement	1, 500	.221	1	Low positive

Results in Table 1 show the Pearson's coefficient $r = (.221)$. Going by the rule of Best and Kahn (2006) as indicated in the method of data analysis, $r (.221)$ is between .20 and .40; therefore, the prediction is low and positive. This shows a low positive prediction exists between academic interest and academic achievement of secondary school students in secondary schools in English Language in Anambra State. Thus, academic interest has low and positive predictive value on academic achievement of secondary school students in secondary schools in English Language in Anambra State.

Testing of Hypothesis

Hypothesis One: Academic interest will not significantly predict academic achievement of secondary school students in secondary schools in English Language in Anambra State.

Table 2: Test of Significance of Pearson's Analysis of the predictive value of academic interest on academic achievement of secondary school students

Variables	N	Academic interest	Academic Achievement	P value	Remark
Academic Interest	1, 500	1	.520	.000	Significant
Academic Achievement	1, 500	.520	1		

Data analysis on Table 2 reveals the Pearson product-moment correlation that was run to determine the significance of the predictive value of academic interest on academic achievement of secondary school students in secondary schools in English Language in Anambra State. The analyses yielded a predictive coefficient value of .520 and p-value of .000. Since the p-value is less than .05 ($.000 < .05$), the null hypothesis is rejected, hence, academic interest significantly predicted academic achievement of secondary school students in secondary schools in English Language in Anambra State.

Summary of Findings

The following findings emerged from this study:

1. Academic interest has low and positive predictive value on academic achievement of secondary school students in secondary schools in English Language in Anambra State.
2. Academic interest significantly predicted academic achievement of secondary school students in secondary schools in English Language in Anambra State.

Discussion of Findings

The first finding of this study was that academic interest has low and positive predictive value on academic achievement of secondary school students in secondary schools in English Language in Anambra State. The testing of the related hypothesis revealed that academic interest significantly predicted academic achievement of secondary school students in secondary schools in English Language in Anambra State. This shows that academic interest significantly predicted academic achievement of secondary school students in public secondary schools in English Language in Anambra State. A unit increase in the level of academic interest is associated with a unit increase in academic achievement of secondary school students in the State. This shows that the prevalence of academic interest by the teachers will greatly enhance academic achievement of secondary school students. That is to say that an increase in the level of academic interest predicts an increase in their level of students' academic achievement.

The finding of this study indicated that academic interest has low and positive predictive value on academic achievement of secondary school students in secondary schools in English Language in Anambra State. This low predictive value is therefore consistent with Okoye (2021) who found that teachers in secondary schools in English Language in Anambra State did not enhance the academic interest of their students through academic engagement in school. A positive relationship was found between academic interest and academic achievement of secondary school students. The findings of Nwite (2015) and Unachukwu and Odumodu (2015) strongly support this position. According to these researchers, when students perceive academic interest to be low, they may not consider themselves valued and part of the school thereby leading to ineffective learning, low class participation and low performance in the school.

This is likely to be so because too much lack of care on the part of the teachers in improving academic interests of the students may likely lead to low academic performance of the students. This may lead to emotional frustration, psychological depression, disordered behaviour and most strongly, loss of class participation, hence, low academic interest. Conversely, increase in academic interest as evident in participation in class activities, rewarding of good performance and equity may increase academic achievement. This is consistent with the result of the findings of Hatami (2015) that academic interest influences students' involvement in the instructional activities. This finding also added that perception of high academic interest also leads to higher academic achievement. Further in the study, the result showed that the relationship between the students' academic interest and their academic achievement is significant. That is to say that students' academic interest is a significant factor in the academic achievement of secondary school students.

Conclusion

Based on the interpretations of the findings on the data collected and analysis and discussion of results, it is concluded that academic interest has low positive predictive value on academic achievement of secondary school students in public secondary schools in English Language in Anambra State. There is also statistically significant prediction between academic interest and academic achievement of secondary school students.

Implications of the Study

The findings of this study revealed that academic interest has low positive predictive values of on academic achievement of secondary school students in public secondary schools in English Language in Anambra State. The implication is that this poses a challenge to the sustenance of qualitative education. The only way is for the government of Anambra State to tackle it through coordinated, articulated and centralized administrative processes which will necessitate high level of effective school counselling. Accordingly, unless the government and principals implement effective school counselling to increase academic interest, students academic achievements is unlikely to improve

Recommendations

Based on the findings of this study, the following recommendations were made.

1. The teachers should use lesson delivery strategies that will enhance academic interest of the students in order to increase the academic achievement of secondary school students since an increase in academic interest can lead to increase in academic achievement of secondary school students.
2. The principals should pay more attention to appreciation, giving of awards, literary and moral appreciation because they make a psychological compensation to students thereby increasing the students' academic interest, and by extension, the academic achievement of the students.
3. As a way of ensuring increase in academic achievement of secondary school students in the secondary school, the teachers should allow students to participate actively in the lesson in order to increase their academic interest and achievement.

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ARTIFICIAL WISDOM AS PREDICTOR OF SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CIVIC EDUCATION IN NNEWI EDUCATION ZONE OF ANAMBRA STATE

Awadiegwu Amaka Emmanuela; Oranusi Ndidi Stella; Udegbe Charles Chigozie
08035001450; 08172852373; 08032903261

Ughenu Nwamaka Perpetua; Edor Job John
08068263677; 07069125847
awadiegwu@gmail.com; ughenuamaka@gmail.com; edorjohn1@gmail.com
Department of Educational Foundations,
Chukwuemeka Odumegwu Ojukwu University,
Igbariam Campus, Anambra State, Nigeria

Abstract

The study determined the predictive value of artificial wisdom on the secondary school students' academic achievement in Civic Education in WAEC Examination in Nnewi Education Zone of Anambra State, Nigeria. The research is guided by one research question and one hypothesis. The researcher employed the correlation research design. The population of the study consisted of 2,927 senior secondary two (SS 2) students from all the 49 public secondary schools in the zone. The sample size comprised 400 SS2 students. Multi-stage sampling procedure was used to draw 16 public schools from the zone. An adapted Tromso Artificial Wisdom Scale (TAWS), and a Civic education Score Profroma, containing the achievement scores of students in Civic education studies in the 2024/2025 academic session, were used for data collection. The adapted TAWS was validated by three experts with a reliability coefficient of 0.71 established using Cronbach alpha method. In analyzing collected data, simple and multiple linear regression analyses were used. The findings from the results revealed among others that artificial wisdom is a significant predictor of secondary students' Civic education achievement. From the findings, the study concluded that artificial wisdom significantly predicted students' academic achievement in Civic education and thus recommended that school principals should implement programs to foster and enhance students' artificial wisdom using mentorship, collaborative learning, and support systems, creating environments that improve students' Civic education achievement and overall emotional well-being.

Keywords: Academic Achievement, Civic Education, Artificial Wisdom, Secondary School Students.

Introduction

Academic achievement refers to a successful accomplishment or Performance in particular subject area. It is indicated by grades, marks and scores of descriptive commentaries. Musek (2011) stated that there are two broad groups of definitions of academic achievement. The first one could be considered more objective, because it refers to numerical scores of students' knowledge, which measure the degree of a student's adaptation to schoolwork and to the educational system. The second group is a more subjective one, as its determination of academic success is reliant upon the student's attitudes towards his academic achievement and himself, as well as by the attitudes of significant others towards his/her success and him/herself. Students' academic achievement refers to how the students deal with or accomplish different tasks given to them by their teachers. (Kayode and Ayodele, 2015). On the other hand, Subramanian (2016), saw academic achievement as excellence in all academic disciplines in the class as well as co-curricular activities. To him

academic achievement includes excellence in sporting, behaviour, confidence communication skill, punctuality, assertiveness art, culture and the like. Academic achievement generally is concerned with students' performance in academic areas like reading or language, history, art, science and mathematics. In this study, the focus is on Civic Education.

Civic education is one of the compulsory subjects that students must pass at the completion of the program in school. According to Okoro (2010), Civic education is aimed at inculcating and development of national and social values in the citizen. It is the study of citizen's rights and duties. It is also concerned with how government works in a society.

Civic education has been identified as one of the most recognized media for dissemination of information in many parts of the world. According to Olorunsogo (2019) over eighty-five percent (85%) of international organizations make some official use of Civic education. That is, Civic education is the official language of communication in United Kingdom, United States of America and also serves as a second language to Asian Countries and many African countries including Nigeria, who has adopted Civic education next to the mother tongue. Stressing further, Olorunsogo (2019) in his study reiterated that Civic education plays a prominent unifying role as the official language of communication among the numerous ethnic groups in Nigeria, and thus used in education delivery at all levels of education. In Nigeria, students at all levels of education are expected to be proficient in the use of Civic education because it is the medium of expression of ideas or knowledge in other subject disciplines, hence, mastery of Civic education is imperative to success in almost all school subjects in Nigeria.

Notably, the dominant medium of instruction at the higher level of education is Civic education. Higher institutions offer admission to only students who made a credit pass in Civic education at O' level. The assumption is that a student who has not made a credit pass in Civic education may not be effective in its usage and may not be able to cope with challenges that may arise from it (Foyewa, 2020). Adeyanju and Egwuogu (2023) observed that effective Civic education usage is a crucial need for students in tertiary institutions who must perform a variety of academic tasks through the instrumentality of the Civic education. A proper mastery of language skills, according to the authors, equips students with necessary ability with which to perform requisite academic tasks in their respective disciplines thereby attaining appropriate academic achievement. Previous research and literatures have shown a decline or fluctuation in academic achievement in Civic education among secondary school students in Nigeria in general and in Anambra State in particular over the recent past. For instance, Anakwe and Dikko (2021) observed that over the years, the general performance of students especially in Civic education in Nigerian schools has not been static. Anakwe and Dikko (2021) asserted that the low achievement of students in Civic education in some secondary schools in Nigeria has been a major source of concern among stakeholders in education and policy makers in the education sector. Fluctuations reported in academic achievement in Civic education among students could be attributed to both intrinsic and extrinsic factors such as social media addiction, poor study habits academic procrastination. Other factors such as students' level of artificial wisdom could also determine their level of academic achievement, which the study investigated.

Artificial wisdom is the ability to understand one's own and others' action. It is the capacity of a person to optimally understand his or her environment and respond properly to it (Obilor and Ikpa 2019). According to Foyewa (2020), artificial wisdom is a multidimensional construct that can accurately measure individuals' ability to read other people and understand their intentions and motivations. It centres on people's interpersonal awareness and social facility, their ability or skill to deal with social relationships effectively, cooperate and collaborate with others, and create and

participate in group activities (Sini and Amalrah, 2019). Considering these definitions, studies have been carried out to ascertain the influence of artificial wisdom on students; learning outcomes. For instance, Obilor and Ikpa, (2019) carried a study to investigate artificial wisdom and academic achievement of senior secondary school students. It was found that significant relationship exists between self-awareness and academic achievement of students; self-motivation and academic achievement of students; and empathy and academic achievement of students. The study concluded that self-awareness, self-motivation, and empathy enhance the academic achievement of students.

The study of Nwogwugwu (2014) revealed that, the performance of student in Civic Education in Makurdi LGA of Benue State in SBA, WASSCE and WAEC SSCE was also good since it was above the bench mark of 45.0. This was also evident in the cluster mean of 51.39 which was above the bench mark. The performance in Civic Education by the students in Makurdi LGA in the three Examinations was again above the bench mark of 45.0. This showed the students performed well in SBA, WASSCE and WAEC SSCE. This was in disagreement with the submission of Ukuije (2011) that teacher-made test items are substandard. The students are prepared for WASSCE and WAEC SSCE using SBA. If the teacher-made items were below standard as submitted, it would have affected the performance of the students negatively. The study found out that, there was a statistically significant difference in the mean scores of the students in English Language, Mathematics and Civic Education in the three examinations (WASSCE, WAEC SSCE and SBA) in Makurdi Local Government Area of Benue State. Civic Education is a subject under the social sciences. It is the study of the rights and duties of citizens, its citizens concerning the government and the civic environment. It is also a study of the ways the government works in a society.

In another study, Raj and Komalavalli (2022) investigated the influence of artificial wisdom on academic achievement of high school students. Results revealed that there was significant relationship between artificial wisdom and academic achievement of high school students. Also, it was found that there was significant difference in artificial wisdom based on gender and type of institution. Girls excelled boys in artificial wisdom and academic achievement. But, while observing the type of institution, government school students were higher in artificial wisdom whereas private school students scored better in academic achievement. Similarly, Sini and Amalraj (2019) undertook study to find the relationship between Artificial wisdom and Academic Achievement among the secondary school students in Kollam District, India. The investigator used Normative Survey Method for the study. From the reviewed literatures, artificial wisdom is related with the individual's ability in relation to his skills in any social situation in a meaningful manner. As a result of this, there is need to investigate the predictive association between artificial wisdom and students' academic achievement in Civic education. The problem of the study posed as a question therefore is individually and jointly, do artificial wisdom significantly predict senior secondary school students' academic achievement in Civic education.

Research question

The following research question guided the study.

What is the Predictive value of artificial wisdom on secondary school students' academic achievement in Civic education in Anambra State?

Hypothesis

One null hypothesis was tested at 0.05 alpha level:

Artificial wisdom does not significantly predict secondary school students' academic achievement in Civic education.

Research Method

This study adopted a predictive-correlational design. Correlation research design aim to ascertain the association that exists between two or more variables that are of interest to the researcher. The area of the study was Anambra state. The population of the study consisted of 2,927 senior secondary two (SS 2) students from all the 49 public secondary schools in the zone. The sample size comprised 400 SS2 students. Multi-stage sampling procedure was used to draw 16 public schools from the zone. An adapted Tromso Artificial Wisdom Scale (TAWS), and a Civic education Score Proforma, containing the achievement scores of students in Civic education studies in the 2024/2025 academic session, were used for data collection. The adapted TAWS was validated by three experts with a reliability coefficient of 0.71 established using Cronbach alpha method. Data collected with the help of two research assistants were analyzed using simple linear regression and multiple regression. The Unstandardized beta coefficient were used to determine the predictive value of the variables which show the increase or decrease in academic achievement, for every unit rise in the predictor variable. The decision rule for accepting or rejecting the null hypothesis was to reject the null hypotheses whenever p value was less than or equal 0.05 ($p < 0.05$) and not to reject the null hypotheses, whenever P value was greater than 0.05 ($p > 0.05$)

Presentation of Results

Research Question 1: What is predictive value of artificial wisdom on academic achievement of secondary school students in Civic education in Anambra State?

Table 1: Regression Analysis of the Predictive Value of Artificial wisdom on Academic Achievement of Secondary School Students in Civic education

Model	R	r^2	Adjusted r^2	Unstandardized coefficients (B)	Std. Error
Constant				60.688	
Artificial wisdom	0.305 ^a	0.12	0.006	0.016	10.77993

- a. Predictors: (Constant), Artificial wisdom
- b. Dependent academic achievement

Table 1 reveals a predictive value of 0.305 indicating a fair positive predictive power/value with associated coefficient determination of r^2 value of 0.12. The coefficient of determination (0.12) known as the predictive value indicates that 12.2% of the variance in students' academic achievement is predicted by their artificial wisdom. Also, the unstandardized Beta coefficient of 0.016 shows that a unit rise in artificial wisdom, increases academic achievement by 1.6%

Hypothesis One: Artificial wisdom does not significantly predict secondary school students' academic achievement in Civic education.

Table 2: Predictive Value of Artificial Wisdom on Academic Achievement in WAEC examination scores in Civic Education

Computed r (r)	r:Squared (r^2)	Adjusted r-Square	Standard error	Beta	t-cal	P-Value	Dec. Sig.
.726	.527	.526	3.43314	.726	13.77	.0000	

From Table 2, r represents the coefficient of prediction which is established on prediction between the two variables. The coefficient of determination (r^2) for computed r value is 0.726. This value indicated that AW is a significant predictor of students' academic achievement in Civic Education in WAEC. On the test of significance of the hypothesis as indicated in table 2, the calculated 't'

value is 9.808 while the p-value is 0.0000. This indicated a significant result between the p-value (0.000) that is less than the level of significance (0.05). Therefore, the hypothesis that Artificial wisdom does not significantly predict secondary school students' academic achievement in Civic education in Civic Educations in Nnewi Education Zone was rejected.

Discussion of Findings

The study revealed that artificial wisdom significantly predicted students' academic achievement in Civic education, positively. This positive and significant prediction can be ascribed to the skills of inter and intrapersonal knowledge imbedded in artificial wisdom that help students develop a wide range of learning-related skills that allow them to study independently, work in groups, build and maintain friendships, respond appropriately to adult feedback and correction, judge others' feelings, temperaments, incentives, as well as sympathize and decode non-verbal signs. Students through the skills of artificial wisdom, interact, understand and collaborate well with others, developing their thinking and social skills, which are tools essential for interaction and exchange of ideas that positively foster their achievement in Civic education. The findings are in line with that of Raj and Komalavalli (2022), Iviemu, (2021), and Sini and Amalraj (2019) who reported in their respective studies that there exists a significant relationship between artificial wisdom and academic achievement of students. The findings however disagree with that of Odofoin, (2022) who reported a no linear relationship between artificial wisdom competencies and academic achievement. By virtue of this finding, this research has joined the school of thought which observed that artificial wisdom is a significant predictor of secondary school students' academic achievement in Civic education.

Conclusion

Based on the findings, the study concluded that artificial wisdom and its dimensions are significant predictors of secondary school students' academic achievement in Civic education. This implies that artificial wisdom when fostered through sensitization and counseling sessions, significantly enhances students' academic achievement in Civic education in Anambra State.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. School principals should implement targeted programs that enhance students' social awareness and social skills. Emphasizing that empathy, emotional regulation, and effective communication can improve artificial wisdom, thereby positively impacting Civic education achievement.
2. The Anambra State Ministry of Education should design interventions focusing on boosting students' reflective and adaptive help-seeking behaviours.
3. secondary school principals in Anambra State should encourage activities such as mentorship, counseling, and resilience workshops to strengthen students' ability to manage academic challenges effectively.
4. Secondary school teachers in the state should adopt teaching strategies that simultaneously foster artificial wisdom and academic resilience. Incorporating collaborative learning, peer support, and emotional skill development into regular lessons can create a supportive learning environment.

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LOCUS OF CONTROL AS PREDICTOR OF SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN ENGLISH LANGUAGE IN ONITSHA EDUCATION ZONE OF ANAMBRA STATE

Uba Mercy Benedette Ifeoma (Ph.D.)

*Department of Educational Foundations,
Alex-Ekwueme Federal University, Ndufu-Alike Ikwo,
Ebonyi State, Nigeria
ifeoma4uba@gmail.com*

Abstract

The purpose of this study was to ascertain the predictive value of locus of control on academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State. The study was guided by one research question and one null hypothesis. A correlational research design was adopted for the study. The Onitsha Education Zone of Anambra state was the area of the study. The population of this study comprised of all the 26,396 secondary school SS II students in Onitsha Education zone. The sample size of this study comprised 1500 secondary school students drawn from two Local Government Areas in the zone. Purposive sampling technique was adopted for this study. Data for this study were collected by means of two structured questionnaires developed by the researcher based on consultation with experts, insight gained from reviewed literature and the specific purposes of the study. Each instruments employed a 4-point rating scale: Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD) with values of 4, 3, 2 and 1 respectively. The validity of the instruments was established. The reliability of the instruments was determined through a trial testing. The data were analyzed using Cronbach Alpha to measure the internal consistency of the instrument and reliability co-efficient values of 0.86 and 0.78 were obtained respectively for each of LOCQ and ACAQ. The instruments were administered to the respondents in their schools by the researcher with the help of three research assistants who were briefed and guided on the modalities for the administration and collection of the instruments. The Pearson Product Moment Correlation was used to answer research question while regression analysis was used to test the null hypothesis at .05 level of significance. Findings indicated that locus of control has a low positive predictive value on academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State. Among others, it was recommended the teachers should set up special classroom interventions geared at enhancing the locus of control of the students so as to increase their academic achievement.

Keywords: Predictive Value; Locus of Control; Academic Achievement; English language.

Introduction

Locus of control is an individual's belief regarding the causes of his or her experiences and the factors to which that person attributes success or failure. This can either be internal or external. If a person has an internal locus of control, that person attributes success to his or her own effort and abilities. A person who expects to succeed will be more motivated and more likely to learn. This person will seek out information and he or she is more likely to have good study habits and a positive academic attitude. On the other hand, a person with an external locus of control attributing their success to luck or fate and will be less likely to make the effort needed to learn.

Locus of control is an individual's perception on the cause of events that he/she endures in his/her life. An individual may have either an external locus of control or an internal locus of control. When an individual has an external locus of control, he/she believes that he or she has little control or power to affect personal outcomes (Wang & Anderson, 2019). If the person has an internal locus of control, he or she understands that he or she is able to control and manipulate things that happen in his or her life. This will be discussed more in depth in the next section on theoretical studies.

An individual's locus of control is a concept that has a significant effect on his or her daily life (Udida, 2022 and **Milon, 2019**). Those with an external locus of control believe that their direct actions do not impact outcomes they encounter. Such individuals, in turn, are less likely to do what it takes to take advantage of the possibilities that life presents. This is due to the possible motivational, emotional, and cognitive deficits an external locus of control creates. People with an external locus of control are more likely to experience other both physical and mental ailments because they believe they have no control over their situation. Those with an internal locus of control believe that hard work and personal abilities will lead to positive outcomes. Such individuals will be more likely to meet challenges and achieve success in their impending endeavours.

In relation to academic achievement, students with internal locus of control were more likely to believe that the achievement was related to their ability and failure related to a lack of effort (Tella, Tella and Adeniyi, 2011). They explained that, at the other end of the continuum were the students with external locus of control who were more likely to reject responsibility for failure. The researcher concludes that for academic success, the students with external locus of control are more likely to believe that their hard work or their intellectual ability do not cause their success. Recent researches have indicated that an internal locus of control is strongly correlated not only with completion of tasks, but also with academic success. Additionally, they reported that locus of control strongly influences academic achievement and decision to graduate from high school.

In the same manner, Tella et al (2011) used a novel multidimensional locus of control instrument Locus of Control, Self-Efficacy and Externality (I-SEE) to investigate the relationship between locus of control, motivation, and academic achievement in three different types of school. The strengths of the I-SEE are that it incorporates the construct of self-efficacy and that it is embedded in a model of personality and action based on field- theoretical conceptions. It includes the role of the environment and personality in determining action. The results support a multidimensional conceptualization of locus of control and the utility of the I-SEE. There were statistically significant differences between schools for motivation and achievement and also a mediating effect between locus of control and school type, suggesting that interactional models are required in investigations of motivation and achievement. Furthermore, moderate levels of locus of control and self- efficacy appear to be more adaptive than either extremely high or low levels.

In the light of these, Tella et al. (2011) suggested that there is need to continue study locus of control since it affects achievement as a predictor of persistence in education. Therefore, there lies a need to re-establish the relation in view of the fact that development has taken place which might bring variation in the results or confirm what has been established in the past. Locus of control is another construct that relates to academic achievement and is explored in this study. Its Latin origin denotes 'location', which refers to individuals' location or place of control of the factors that affect them, such as luck or family influence. The term was coined by Rotter who explained social learning theory of the personality of human beings. Rotter (1954) believed that

reinforcement guides human behavior and that the contingencies of reinforcement (relating to rewards and punishments) influence people's beliefs about what causes of their actions. In relation to education, students have two possible outcomes, which are success and failure, and they are preceded by different causal attributions. Students' successes and failures influence their emotional reactions and the degree to which the outcomes change their expectations for subsequent future outcomes (Sambo and Balarabe, 2012).

Based on Rotter's theory, students who attribute their success or failure to themselves, which includes a number of internal factors such as abilities, skills, effort and capabilities, are referred to as having internal locus of control (ILOC), also known as the internals. Those that attribute their academic outcomes to factors other than themselves are said to have external locus of control (ELOC), also known as the externals. Thus, people with ILOC believe that life outcomes are largely under their own control and depend on their behavior or activities. As a result, such people have a high level of confidence, resilience, security, and a positive outlook, and feel no real need for external approval (Santrock, 2003). They are less likely to conform and less likely to be obedient. Conversely, people with ELOC have the opposite trait of those with ILOC. They attribute their outcomes more to the influence of external factors such as luck, chance and powerful people. Externals, unlike internals, tend to be less confident, easily excited, more nervous, and insecure.

Consequently, ELOC people conform more to the law and are easily influenced by others and by events; this is possibly the reason Halpert and Hill (2011) suggested that whether or not people believe a situation or event is under their own control will influence their reward expectancy and behavior. Similarly, Ahman-Mahmud (2016) noted that ILOC and ELOC individuals differ not only as to their attentiveness to information immediately present in the environment, but also in terms of their actively seeking additional relevant information. Thus, internals put more effort into improving their skills to succeed in future tasks, while externals do not and are unlikely to perform better, since they attribute the outcome (success or failure) to luck, fate and others.

Similarly, Weiner in 1976 extended the LOC theory to include other factors of stability and control. Weiner explained that individuals attribute their performance outcomes of success and failure to internal and external factors, as stated by Rotter, but that degrees of ILOC or ELOC may not be on a continuum. That is to say, a person's internality or externality could be stable or unstable in different or similar situations and events, which Russell in 1982 called 'situational variability'. Also, it may depend on whether the outcome in question actually is within a person's control or is uncontrollable. Weiners theory put forward in 1976 provided in-depth insight into outcome beliefs. Individuals can make internal or external attributions in different situations depending on the circumstances of the events surrounding the outcome.

Understanding the various circumstances of people's beliefs regarding success and failure, as in the case of this study's sample, can yield better insight into some of the problems leading to poor performance. Such an understanding can indicate their attribution factors whether their outcome beliefs are stable and whether they can control the factors that influence their LOC or not. A cross cultural study (Hinggins and Bhatt, 2001) provided evidence to support differences in people's LOC in different cultural perspectives. The study demonstrated that people from communal culture were had emic perspective which is linked to external tendencies compared to etic perspective of people from the western culture who are mostly individualistic in their beliefs.

Hinggins and Bhatt's study explores the students' LOC factors based on Rotter's theory to gain broader perspective on their control beliefs. Either belief, internal or external, is likely to affect the academic performance of the individual, whether positively in the case of ILOC or

negatively for those with ELOC, as externals would attribute outcomes to fate, task difficulty or other people rather than expend the effort to improve themselves.

Most research indicates high ability and gifted students have an internal locus of control (Siegle, Rubenstein, Pollard and Romey, 2010), with locus of control becoming more internal through the school years and beyond (Kormanik & Rocco, 2009). It was indicated that high achieving gifted students had a significantly higher internal locus of control than both underachieving gifted and non-gifted students. Similarly, studies have shown that high achievers have higher internal locus of control scores than underachievers. An external locus of control may be associated with classroom stress and classroom burnout (Rinn and Boazman, 2014), which could also lead to underachievement. High ability students seem to often perceive themselves to be cognitively competent and therefore are less likely to attribute failures to a lack of ability than their average achieving peers. Further, high ability students had more confidence in their own personal control over successes and failures in their school coursework than their average ability peers. In other words, gifted students tended to believe they have more control over their coursework due to the fact that they could control the learning strategies they used and the amount of effort they put in to their work.

Within the gifted population, level of ability may play a role in individual locus of control. In a study of highly, moderately, and mildly mathematically gifted Finnish adolescents and adults, Nokelainen, Tirri, and Merenti-Välimäki (2007) found that highly and moderately mathematically gifted individuals believe ability is more important for success than effort, while mildly mathematically gifted individuals believe effort is more important for success. In addition, moderately and mildly mathematically gifted individuals believe a lack of effort causes failure, while highly mathematically gifted individuals believe a lack of ability causes failure.

Presently, there are quite a large body of research Bodill and Roberts (2013); Grantz (2012); and Fakeye (2011) on the relationship between LOC and academic achievement. Most of these studies demonstrate a consistent positive relationship between LOC and a range of academic achievement related factors, such as school attendance, career aspiration, school adjustments, task completion and goal attainment. This relationship, according to previous researchers, is predicated on how individuals attribute their successes and failures in school to themselves, their own efforts and abilities, or to other factors, such as the difficulty of the task or fate. While internals may express pride in good outcomes and feel ashamed of bad outcomes, externals would experience less intense emotions in relation to their academic outcomes. Consequently, these indicated that greater internality is associated with higher academic achievement. In a similar note, Grantz (2012) found that internals earn better grades and work harder because they spend more time on homework and study longer for tests than externals. Also, Bodill and Roberts (2013) found that the number of hours spent studying was predictive of LOC and performance in that internals exert persistence and effort in studying longer due to their belief that it results in good academic achievement. This is perhaps why internals engage in difficult tasks and do not give up easily when given negative feedback. They would rather change their strategy than resign themselves and their outcomes to external factors or assign blame to others.

However, this means that students can easily be discouraged due to consistently poor performance despite efforts at achieving better grades. This can result in lack of interest and perseverance at school tasks, and ultimately, they may find it easier to avoid potential damage that might occur due to attributing failures to their own fault or ability. Therefore, they start to make external attributions rather than to accept blame. Keith, Pottebaum, and Eberhart (2012) posit that LOC has a meaningful impact on high school seniors because in their study, the students with ILOC had higher achievement levels while ELOC was associated with low scores. Competent students

readily take responsibility for their outcome irrespective of whether it is positive or negative and develop self-regulation skills for improvement, whereas less competent students reject responsibility for their performance outcome (Fakeye, 2011). Sambo and Balarabe (2012) reported that students with ILOC who had low scores exhibited feelings of worry, while externals showed a lack of concern. This could suggest that the externals who attribute the cause of their performance to external factor may not see any reason to worry. They may think that there is nothing they can do to improve outcome while the internal may be preoccupied with the kind of strategies (efforts or abilities) to exert in preparation for future outcomes, which could explain their anxiety and self-mood.

In another study on students' performance in a computer assisted language learning program demonstrates the relationship between LOC and academic achievement because internals showed autonomy and exhibited confidence in applying instructions and performing the computer skills compared to the externals (Mei-Mei and Chiung-Mei, 2014). This illuminates the aspects of dependency and learner control in learning situations, as some people learn effectively without needing much assistance while others do not. The indication is that with little guidance, internals can go further to achieve while externals may need more help and probably more time. Internals are guided by their own decisions, are more self-determining and more active in the quest for knowledge and information related to events and factors that affect them (Fakeye, 2011). Similarly, Fakeye further stated that LOC is reported to improve with age, in that as people grow older, they tend to become more internal than external. However, a longitudinal study among four ethnic groups in the U.S. found LOC to be stable among the adolescents over the period of four years (You, Hong and Ho, 2011).

In situations of both success and failure, externals attribute outcomes to external factors, believing failure to be destiny, while internals continue to work harder, believing that they will succeed in the end. It is therefore logical that if one will succeed at the end, he or she should continue to persevere to reach their goal. Externals, on the other hand, may not attempt to improve on future tasks since they feel that they cannot control their attainment of high academic achievement and will therefore stop trying. The review of the related literature reveals that LOC is related to academic achievement in those students with ILOC tend to have higher academic achievement compared to those with ELOC. However, the prior achievement of the students influences their control beliefs indicating whether they are ILOC or ELOC, which will further affect their future performance. Internals adopt new strategies to improve, while the activities and behaviours of externals are contrary and even detrimental to subsequent achievement. Therefore, knowing the qualities of each of these two different groups is important to practitioners, as they require broader teaching and varied learning strategies to achieve good performance in school. Accordingly, this study ascertained the predictive value of locus of control on academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State.

Research Question

The following research question guided the study.

1. What is the predictive value of locus of control on academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State?

Hypothesis

The following null hypotheses will be tested at 0.05 level of significance.

1. There is no significant prediction between locus of control and academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State.

Research Method

Research Design

A correlational research design was adopted for the study. A correlational study design seeks to determine the extent, direction and magnitude of relationship between two or more variables (Nworgu, 2015).

Area of the Study

The study was carried out in the Onitsha Education Zone of Anambra state. It is one of the six education zones in Anambra State namely: Awka, Onitsha, Ogidi, Aguata, Otuocha and Nnewi with two hundred and sixty-one (261) secondary schools (Source: Post Primary School Service Commission, PPSSC, 2022).

Population of the Study

The population of this study comprised of all the 26,396 secondary school SS II students in Onitsha Education zone.

Sample and Sampling Technique

The sample size of this study comprised 1500 secondary school students drawn from two Local Government Areas in the zone. The purposive sampling technique was adopted for this study.

Instrument for Data Collection

Data for this study were collected by means of two structured questionnaires developed by the researcher based on consultation with experts, insight gained from reviewed literature and the specific purposes of the study. Each of the instruments employed a 4-point rating scale of Strongly Agreed (SA); Agreed (A); Disagreed (D) and Strongly Disagreed (SD) with values of 4, 3, 2 and 1 respectively. The first instrument which consist of 20 items is titled "Locus of Control Questionnaire (LOCQ)". The second instrument was titled: "Academic Achievement Questionnaire (ACAQ)".

Validation of the Instrument

To ascertain the face validity of the instruments for the study, the researcher submitted them together with the research topic, purpose of the study, research question and hypothesis to two experts in Faculty of Education, Nnamdi Azikiwe University, Awka. These experts were requested to validate the instrument relative to the appropriateness of the structure, instructions, item statements and content coverage and freely modify the sections as they deem fit. The experts made necessary corrections and adjustments. The researcher utilized the experts' observations and suggestions in the final production of the instruments.

Reliability of the Instrument

The reliability of the instrument was determined through a trial testing. Copies of the instrument were administered to 20 secondary school students in two secondary schools in Enugu State. The data were analyzed using Cronbach Alpha to measure the internal consistency of the instrument and reliability co-efficient values of 0.86 and 0.78 were obtained respectively for each of LOCQ and ACAQ. The reliability indices for the instruments were considered high enough to judge that the instrument is reliable. Accordingly, Frankel and Wallen, (2016) maintained that items will be considered reliable (and desirable for consistency level) if they yield a reliability coefficient of 0.70 and above. Based on the above observation, the instruments were therefore considered reliable.

Method of Data Collection

The instruments were administered on the respondents in their schools by the researcher with the help three research assistants who were briefed and guided on the modalities for the administration and collection of the instruments. A period of two weeks was used for the distribution and collection of the instruments. An on-spot approach method was used in data collection. Follow-up visits were used where the respondents could not attend to the instruments on the spot. The copies of questionnaire correctly filled and successfully retrieved were subjected to data analysis.

Method of Data Analysis

The Pearson Product Moment Correlation was used to answer research question while regression analysis was used to determine the r^2 and adjusted r^2 . The co-efficient “r” obtained was used to ascertain how each of the independent variables predicted the dependent variable. Following Best and Khan (2006), the research question was interpreted using the real limit of numbers of:

0.02	-	0.39	weak prediction
0.40	-	0.59	Moderate prediction
0.60	-	0.99	Strong prediction

In interpreting the values of the null hypothesis, when p-value was less than or equal to 0.05 ($p \leq 0.05$), the null hypothesis was rejected. On the other hand, when the p-value was greater than 0.05 ($p > 0.05$), the null hypothesis was not rejected.

Result and Discussion

Research Question: What is the predictive value of locus of control on academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State?

Table 1: Pearson’s Product Moment Correlation Analysis of the predictive value of locus of control on Students’ Academic Achievement in secondary schools

Variables	N	Locus of control	Students’ Academic Achievement	Remark
Locus of control	1, 500	1	.304	
Students’ Academic Achievement	1, 500	.304	1	Low positive

As shown in Table 1, the predictive value between locus of control and academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State is $r = .304$. The predictive value coefficient (.304) is between .20 and .40 which shows that a low positive predictive value of locus of control and academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State ($r = .304$, $n = 1, 500$). Thus, locus of control has a low positive predictive value on academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State.

Testing of Hypotheses

Hypothesis: There is no significant prediction between locus of control and academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State.

Table 2: Test of Significance of Pearson's Analysis of the predictive value of locus of control on Students' Academic Achievement

Variables	N	Locus of control	Students' Academic Achievement	P value	Remark
Locus of control	1, 500	1	.372	.030	Significant
Students' Academic Achievement	1, 500	.372	1		

The analysis on Table 2 shows that Pearson product-moment correlation was to determine the significance of locus of control on students' academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State. The analyses yielded a predictive coefficient value of .372 and p-value of .030. Since the p-value is less than .05 (.030 < .05), the null hypothesis is rejected. Therefore, locus of control significantly predicted students' academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State.

Summary of Findings

The following findings emerged from this study:

3. Locus of control has a low positive predictive value on academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State.
4. Locus of control significantly predicted students' academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State.

Discussion of Findings

The study revealed that locus of control has a low positive predictive value on academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State. This finding of the study is analytically important as it concerns teaching and learning processes in the school. In a school where the teachers effectively enhance the students' locus of control, it is most likely that students' academic achievement is likely to be high. That is to say that the positive predictive value between the two variables (locus of control and students' academic achievement) shows that a unit increase in students' locus of control by the teachers correlates with a unit increase in the students' academic achievement. This shows that when students' locus of control increases, academic achievement level increases.

This finding is a confirmation of Heidari, Mokhtari and Mashhoodi (2019) whose study found that students with high level of locus of control are dedicated in making a difference; they show

willingness to devote personal time to studies and achieve maximally in class works. The findings of Cooper and Findley (2020) also supported this view that no matter the availability of instructional resources in the school system, they mean nothing if there are students with low locus of control. This is because in some school, individual students would more likely identify with their school, show more desire to carry out the goals of teaching, willingly take on the tasks assigned to them and to acquire knowledge necessary for them to perform maximally.

Further findings of the study indicated that locus of control significantly predicted students' academic achievement in secondary schools. This finding is not surprising to the researcher. It was expected that there would be no significant correlation between students' locus of control and students' academic achievement because the analysis of the research question indicated that locus of control has a low positive predictive value on students' academic achievement. However, the only explanation was low and therefore not significant based on the hypothesis test. This finding of the study is supported by the findings of Eckstein (2018) which indicated that there is no significant positive relationship between locus of control and students' academic achievement.

Conclusion

Based on the findings and the discussion of results, it is concluded that locus of control has low positive predictive value on academic achievement of secondary school students in English language in Onitsha Education Zone of Anambra State. There is statistically significant correlation between locus of control and students' academic achievement.

Recommendations

Based on the findings of this study, the following recommendations were made.

1. Teachers should implement classroom interventions aimed at enhancing students' locus of control to improve academic achievement
2. The Ministry of Education should formulate policies that will ensure that students' locus of control is enhanced in order to increase students' academic achievement.
3. As a way of ensuring increase in students' locus of control, teachers in the secondary schools should allow students to participate actively in class activities.
4. Students should maintain high locus of control through active participation in class activities so as to enhance their academic achievement.

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RELATIONSHIP BETWEEN PRINCIPALS' NON-CONFRONTATIONAL CONFLICT MANAGEMENT STRATEGY AND TEACHERS' COMPLIANCE WITH DIRECTIVE IN SECONDARY SCHOOLS IN ANAMBRA STATE

Prof. Isaac N. Nwankwo

Department of Educational Management and Policy

Faculty of Education

Nnamdi Azikiwe University, Awka

in.nwankwo@unizik.edu.ng

Abstract

The purpose of the study was to determine the relationship between principals' non-confrontational conflict management strategy and teachers' compliance with Principals' directives in public secondary schools in Anambra State. The study was guided by nine research questions and nine null hypotheses. The correlational research design was adopted. The population of the study was made up of 6,815 teachers while the sample of the study was 2,727 teachers sampled using proportionate random sampling technique. Two instruments developed by the researcher were used for data collection. The first instrument is titled "Principals' Conflict Management Strategies Questionnaire (PCMSQ)" while the other is "Teachers' Engagement in School Activities Questionnaire" (TESAQ). The instruments were validated by three experts who are lecturers, one from Measurement and Evaluation, Department of Educational Foundations and the other two were lecturers in Educational Management and Policy, all in Faculty of Education, Nnamdi Azikiwe University Awka. The reliability of the instrument was established using Cronbach's alpha method. Alpha coefficients of 0.78 was obtained in PCMSQ while a coefficient of 0.80 obtained for TESAQ. The researcher administered the copies of the instrument with the help of 5 research assistants each covering the six education zones. The Pearson Product Moment Correlation was used in data analysis, and It was found that and significant relationship existed between non-confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State and it could be linked to the fact that teachers tend to align with non-confrontational style given that it ensures the accommodation of their interest. Based on the findings, it was recommended among others that Ministry of Education should periodically organize seminars and workshops for principals on the need to continually adopt non-confrontational conflict strategy for compliance to principals' directives by teachers.

Keywords: Principals, Non-confrontational; Conflict Management Strategy, Teachers; Compliance; Directives.

Introduction

Every formal organization has stated objectives to achieve. The achievement of the stated objectives is partly dependent on human resources who are different in many ways. The differences in persons are mostly the causes of conflicts in formal organizations. Thus, conflict is an inevitable feature of organizational life which arise due to people's different interests, perceptions, personalities, attitudes, values and views. This leads to differences in opinions in the organization thereby causing conflict. Conflicts are not entirely bad in human organizations. All depend on how the conflicts are handled. Conflicts, when properly managed, are relevant for adjustment in the process of achieving the goals or objectives of the organization. In situations where they are not properly managed, they hinder the organizational goal attainment. Conflicts are perceived differently by different people.

According to Wilmot and Hocker (2015), conflict is a struggle over perceived incompatible differences in beliefs between two or more interdependent individuals. This may include differences in values, desires for esteem, control, and correctness. Ghaffar (2019) saw conflict as an important and inevitable human phenomenon emanating wherever diverse interests exist. Similarly, Mullins (2020) defined conflict as behaviour intended to obstruct the achievement of some other person's goals. In the same manner, Obi (2021) noted that organizational conflict is an act of discontentment and contention which either the workers or employers of labour employ to put unnecessary pressure against each other so as to get their demands. In a similar vein, Kazimoto (2023) stated that conflict is described as the presence of discord that occurs when goals, interests or values of different individuals or groups are incompatible and frustrate each other's attempt to achieve objectives in an organization.

In contemporary secondary school settings, principals frequently encounter interpersonal conflicts among staff that, if mismanaged, can undermine school harmony and organizational effectiveness. There are several plausible causes of organizational conflicts. Mostly they involve factors such as mismatch of opinions between members of the same team or maybe a difference of understanding between authorities at workplace (Franks et al, 2014). Few reasons for conflicts in organizational environment can be due to structural or non-structural based factor which are:

1. **Poor Communication:** One of the most significant issues of organizational conflicts include poor communication or miscommunication. Different communication patterns often lead to misinterpretation of various topics, which lead to a false impact on the brain regarding the person talking on the topic. This results in a conflicting attitude on the discussion itself. A simple instance such as manager reassigning a worker's task to his/her colleague, but failing to mention it to the concerned worker, or communicating his intentions to the worker before assigning the task, might lead to the employee harboring negative perception about the manager. Repetitive occurrences of this nature in the future might lead to the employee's poor organizational conduct as a whole or towards the manager and might lead to serious organizational conflicts. Thus, it can be observed how miscommunication or absence of proper communication leads to conflict within an organization. Hence, poor communication not only gives rise to conflicts in the workplace itself but also negatively affects productivity of the entire working group (Odle-Dusseau, Britt & Greene, 2022).
2. **Organizational Structure:** The structure wherein an organization is formed plays a very determining role in the conflict area. A simple example can be observed in the fact that in case of a matrix-structured company, decisional conflicts are almost built-in, as it is specified in the structure itself that an employee should report to two bosses (Gelfand et al, 2022). This type of structure will almost always lead to confusion as the company is segmented into smaller parts, always having two opinions on one issue.
3. **Role Ambiguity:** The design of authority in the organizational structure determines the chances of arise of conflict. An ill-defined authority-responsibility relationship will definitely lead to a conflict. The lack of consistency in work is observed when such authority-responsibility relationships are not properly or rather clearly defined. Communication problems creep in and crack open wedges of conflict. Intergroup conflicts are usual results of such weak organizational structures (Sonnentag, Unger & Nägel, 2021).
4. **Contradicting Personalities:** This encircles one of the most common reasons for conflict in office scenarios. Differences in personality in the workplace are as common and expected as sand on a seashore. Employees come to work from different ethnic backgrounds, having had

different experiences and harbor a different and individualistic mindset, thus forming a unique character of each to understand. In the case when one worker fails to understand the other in certain areas or maybe in areas relating to the area of the work assigned to them, conflicts take place (Deyoe & Fox, 2020). A proper instance might include having a straightforward-minded employee who believes in speaking the truth or what he feels directly, without considering the effects of it. This straightforward persona might affect or insult the other workers surrounding if it is such a topic. Sometimes the person with the straightforward attitude might feel offended as well in case the other workers do not behave in that manner with him and keep stuff away from him.

- 5. Frustration and Stress:** Conflict arises in situations where the parties involved are too stressed out or frustrated with their own work. Stressed out people are more likely to start a quarrel with a properly functioning co-worker. This shall in turn reduce productivity on the overall front. Causes of such stress can be as simple as unwanted noise, lack of privacy, untidy workplace, or very serious such as threats of violence, harassment, extreme negative criticism (Riaz & Junaid, 2022).
- 6. Competition Centering Resources:** Resources like equipment, money or time are usually limited and scarce. It is a very natural phenomenon that competition among workers for such resources is a frequent source of conflict. Cutting-edge gadgets and accessories like laptops and iPhones might be allocated to a certain rank of employees whereas others may be deprived of it. Some employees might hold the view that those technical devices are crucial for their productivity and might revolt in extreme cases. This leads to severe competition at times. Such unhealthy competition gives rise to an unethical environment in the office itself, thus lowering the workplace morale as a whole. This in turn demotes teamwork and encourages individualism (Katz & Flynn, 2023).

Difference in Values: Sometimes there exists a certain age gap between the employees at the workplace. Although this is mostly a good thing as the junior get a lot of experience and can as well learn from the senior people, but this also leads to certain conflicts between people sharing a generation gap. The values have changed down the time due to the advancement of society, and the society has become more open and accepting too many new reforms, which may not always sit right with the older generation. The difference in values is not always the harbinger of conflicts but the arrogance to of not accepting such change is. Dealing on the lines of such values, quarrels often breakout and insults only fuel such conflicts (Leithwood, Harris, & Hopkins, 2020).

To navigate the challenges posed by conflicts in schools, many school leaders adopt different conflict management strategies so that the negative effects of conflicts could be minimized or controlled. There exist several strategies that could be used to resolve conflict in schools. These include: dominance, compromise, synergy, culture of civility, win-lose strategy, lose-lose strategy, win-win strategy (Anashie and Kulo, 2020); integration, obliging, smoothing, avoidance, mediation (Best, 2016); dialogue, arbitration, conciliation, diplomacy (Crossfield & Bourne, 2018); negotiation, effective communication, accommodating (Rahim, 2016); non-confrontational, dialogue-control, effective communication (Ogazi, 2021); collaborating, competing, harmonizing (Oshionebo and Ashang, 2017); adjudication, collective bargaining, confrontation, problem solving, creation of budget committee, separation device, neglect or silence, clarification of inter dependencies, consultation, boxing the problem, clarification of

goals, and prayer (Ihuarulam, 2017). Secondary school principals are therefore, open to various strategies to apply in any given conflict situation in their schools. There is no one best conflict management strategy that may be used in all conflict situations. Different conflicts may require different strategies, with the choice of strategy, depending on the nature of the conflict or the parties involved. The focus of this study is on the non-confrontational conflict management strategies, which emphasize empathy, diplomacy, active listening, and at times, strategic avoidance. This strategy aims to preserve relationships and minimize escalation, thereby contributing to a stable and positive school climate (Wilmot & Hocker, 2015).

Non-confrontational conflict management strategies refer to accommodating behaviours that include the passive acceptance of the decision of a partner for the benefit of partner in a conflict episode. Non-confrontational conflict management strategies as (Gunuc, 2013) opined, involve the extent to which individual seek to avoid or downplay the significance of conflict scenarios. These involve letting go in the interest of peaceful co-existence via the avoidance of its discussion. David and Paul (2018) asserted that non-confrontational conflict management strategies are placating in nature. In school situation, the principals yield and give power to teachers to make them feel better. These strategies are used when principals are willing to sacrifice personal interest and convenience to satisfy the needs of others; teachers inclusive. The emphasizes is on maintaining the relationship. It is beneficial when one is mistaken or when you wish to reduce losses since it retains relationships (Amie-Ogan & Eziri, 2021).

Non-confrontational conflict management strategies promote the giving up of the wishes or demands of a party in favor of another (Thote & Gowri, 2020). In other words, it is a 'win-lose' approach. This is where the principals try to meet the needs of all those who are involved in the conflict. For instance, to maximize the teaching time, the principal may demand that remedial lessons be held outside the stipulated teaching time. The school principals view teachers as competent and does not want to lower their morale, they may retain the stipulated teaching time to maintain a good relationship with the teachers.

One widely used non-confrontational technique is avoidance which is deliberately postponing conflict engagement to allow time for emotional cooling or information gathering. While often viewed as passive, in practice, this strategy can serve as a deliberate and tactful method of conflict containment (Tschannen-Moran, 2024). When implemented thoughtfully, such strategies foster emotional safety, mutual respect, and collaborative problem-solving among school staff (Fullan, 2024).

The relevance of non-confrontational strategies becomes even more apparent when considering their impact on teachers' compliance with principals' directives. Compliance in this context refers to the extent to which teachers adhere to the rules, procedures, and instructions issued by school leadership. High levels of compliance are essential for maintaining institutional order, achieving instructional goals, and fostering a culture of professionalism and accountability (Leithwood, Harris, & Hopkins, 2020).

Several interrelated factors influence teachers' compliance, including the clarity of directives, the communication style of the principal, the perceived legitimacy of the principal's authority, and the degree to which teachers are involved in decision-making (Hoy & Miskel, 2022; Robinson, Lloyd, & Rowe, 2018). Notably, the use of respectful and collaborative communication often found in non-confrontational leadership approaches enhances teachers' willingness to follow directives. This underscores the critical link between conflict management style and teacher behaviour within schools.

Given the complex interplay between leadership style and staff cooperation, this study explored the relationship between non-confrontational conflict management strategies and teachers' compliance with principals' directives in secondary schools. Understanding this relationship is vital for improving leadership practices and promoting a cohesive school environment conducive to teaching and learning.

Statement of the Problem

Given the adverse effects of conflicts on teachers' compliance with principals' directives in the school system, principals who are the administrators adopt several conflict management strategies to influence teachers to comply with directives and take active part in school activities. Ogazi (2021) identified three conflict management strategies that are commonly applied by administrators to include non-confrontation, dialogue-control and effective communication conflict management strategies. Fouts (2021) opined that each of these conflict management strategies has the potential to influence teachers' compliance with principals' directives or disengagement with schools. Where a high level of teachers' compliance with principals' directives is fostered, teachers work jointly with school principals to improve school's effectiveness.

In public secondary schools in Anambra State, it is quite unfortunately that most teachers do not comply with principals' directive or engage actively with school activities and this is one of the problems challenging secondary school growth in the State. Accordingly, the researcher's interaction with many school students revealed that some teachers in their various schools hardly comply with principals' directives or engage in school activities. They go to school at will, involve in private business practices during school hours, and give out notes to students to copy without teaching. Further interactions indicated that there are many rivalries among the teachers in the schools. Expressing concern over the dangers of lack of compliance with principals' directives and teachers' disengagement with school, Ucheoma (2024) noted that teachers' disengagement and non-compliance with principals' directives are leading manifestations of indiscipline among teachers. Falae and Onofeghara (2017) were of the opinion that the standard of students' academic work is decreasing in quality as a result of teachers' indiscipline. In many secondary schools in Anambra State, there are seemingly high levels of teachers' non-compliance with directives of their principals which manifest in gross indiscipline among the teachers, rivalry with the principals, truancy and laxity towards class work, loitering and absenteeism from classes and engagement in private business practices during school hours (Ogbonnaji & Ucheoma, 2024). The grave implications of these manifestations of teachers' non-compliance with directives have warranted this study into the variables that are often blamed for the teachers' indiscipline in school.

At this juncture, it is reasonable to argue that teachers' non-compliance with principals' directives is the major cause of lack of cooperation among staff which in turn, hinders the attainment of school objectives. Could the cases of lack of teachers' compliance with directives be associated with strategies the principals adopted in managing conflicts? In other words, is there any relationship between principals' non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State? The concerns of this study were to provide answers to these questions by empirically investigating whether the non-confrontational conflict management strategies adopted by school principals have significant relationship with teachers' compliance with principals' directives in public secondary schools in Anambra State.

Research Question: What is the relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State?

Research Hypothesis: There is no significant relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State.

Research Method

It's a correlation study, carried out in public secondary schools in Anambra State. The population of the study was made up of 6815 secondary school teachers in the six education zones in Anambra State. The composition of the population based on education zones include: 1657 teachers in Awka zone, 1254 teachers in Onitsha zone, 1047 teachers in Aguata education zone, 1122 teachers in Nnewi zone, 1097 teachers in Ogidi zone, 638 teachers in Otuocha zone. The data were obtained from Post Primary Secondary School Commission (PPSSC, 2023). Simple random sampling technique was used to draw the sample of 2727 teachers in the six education zones using 40%, which 2340 data were recovered.

Two instruments developed by the researcher were used. The first instrument is titled "Principals' Conflict Management Strategies Questionnaire (PCMSQ) and while the second is tagged "Teachers' Engagement in School Activities Questionnaire" (TESAQ). The instrument was validated by experts. The reliability of the instrument was established using Cronbach alpha method and co-efficient values for PCMSQ and TESAQ were 0.78 and 0.80 respectively. The questionnaire was administered to the respondents in their various schools with the help of research assistants. Pearson Product Moment Correlation was used to analyse data.

Research Question: What is the relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State?

Table 1: Pearson's Product Moment Analysis of the Relationship Between Non-Confrontational Conflict Management Strategy and Teachers' Compliance with Principals' Directives in Secondary Schools in Anambra State

Variables	N	R	p-value	Remark
Non-Confrontational Management Strategy	2340	.221	0.04	Moderate Positive Relationship
Teachers' Compliance with Principals' Directives				

Results in Table 1 show the Pearson's coefficient $r = (.221)$. This therefore indicated that there is a moderate positive relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State. Thus, principals non-confrontational conflict management strategy has a moderate positive relationship with teachers' compliance with principals' directive in secondary schools in Anambra State.

Research Hypothesis: There is no significant relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in secondary schools in Anambra State.

Table 2: Pearson r on relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives.

Source of Variation	N	R	p-value	Remark
Non-Confrontational Management Strategy	2340	0.540	0.04	Moderate Positive Relationship
Teachers' Compliance with Principals' Directive				

Data in Table 2 show that there is a moderate positive relationship existing between non-confrontational conflict management strategy and teachers' compliance with principals' directives. This is evident by the size of Pearson's Correlation Coefficient r , which is 0.540. Furthermore, the analysis shows that there is a significant relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives. The calculated r (0.540) has p -value <0.05 . The null hypothesis two was therefore rejected.

Discussions of Finding

Based on the finding of the study, it showed that a moderate positive and significant relationship existed between non-confrontational conflict management strategy and teachers' compliance with principals' directives. This could be linked to the fact that teachers tend to align with non-confrontational style given that it ensures the accommodation of their interest. Consistent with the finding of the current study, Thote and Gowri (2020) observed that non-confrontational conflict management strategies promote the giving up of the wishes or demands of a party in favour of another. In other words, it is a 'win-lose' approach. This is where the principals try to meet the needs of all those who are involved in the conflict. Here, the school principals view teachers as competent and does not want to lower their moral, they may retain the stipulated teaching time to maintain a good relationship with the teachers. This, to all intents and purposes, promotes teachers' compliance with principals' directives.

Summary of Finding

A moderate positive and significant relationship existed between non-confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State.

Recommendation

This suggestion is made to improve teachers' compliance with principal's directive

2. The ministry of Education should organize regular workshops for principals, emphasizing the importance of continually using non-confrontational conflict management strategy in order to encourage and improve teachers' compliance with principals' directive.

Conclusion

The adoption of non-confrontational conflict management strategy by principals plays a vital role in fostering teachers' compliance with principals' directives. By cultivating an atmosphere of mutual trust, respect, and inconclusiveness, principals are able not only to address conflicts

effectively but also strengthen teachers' professional commitment and promote overall school improvement.

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SELF-ESTEEM AS PREDICTOR OF SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN AWKA EDUCATION ZONE: IMPLICATIONS FOR CLASSROOM MANAGEMENT

Dr. Okeke, Nonyem Ifediorah

Department of Educational Foundations,
Chukwuemeka Odumegwu Ojukwu University,
Igbariam Campus, Anambra State, Nigeria
ifedinoke@yahoo.com

Abstract

The purpose of this study was to determine the predictive value of self-esteem on academic achievement of secondary school students in Mathematics in Awka Education Zone of Anambra State with implications for classroom management. One research question and one null hypothesis guided the study. The study was carried out using correlational research design. It was conducted in the Awka Education Zone of Anambra state. The zone has a total population of 3,890 SSSII students. The sample of the study consisted of 300 senior secondary school students (SSII) drawn from the students' population in the zone. Stratified sampling technique was used to select subjects for this study. Simple random sampling technique was used in selecting the sample. The instruments for data collection were two questionnaires. The first instrument is the Rosenberg Self-Esteem Scale structured with four-point scale of Strongly Agree (SA); Agree (A); Disagree (D); and Strongly Disagree (SD). The face and content validity of the instrument was ascertained by giving copies of it to two experts in the Faculty of Education, Nnamdi Azikiwe University Awka. For the Rosenberg scale, it is already a widely-known and most utilized instrument for measuring self-esteem because it is standardized. Several Nigerian studies have utilized the instrument and found it consistently valid. The Rosenberg Self-esteem Scale was deployed for use with a Cronbach Alpha reliability coefficient of 0.77 as determined by Rosenberg (1965). The questionnaire was administered by the researcher with the aid of two research assistants and was through direct contact and completed copies were collected on the spot. The Pearson Product Moment Correlation was used to answer research question while regression analysis was used to test the hypothesis. Findings indicated that self-esteem has a low positive predictive value on academic achievement of secondary school students in Mathematics in secondary schools in Anambra State. Among others, it was recommended that government should set up special intervention programme geared at boosting the self-esteem of the students as this will improve academic achievement of secondary school students in Mathematics.

Keywords: Predictive Value; Self-Esteem; Academic Achievement; Mathematics

Introduction

Self-esteem is simply how a person feels about him/herself and how he/she judge him/her worth. Self-esteem is a very important aspect of self-development because it is the evaluation of one's competencies as it affects one emotional experience, future behaviour and long-term psychological adjustment. Self-esteem means how people think about themselves, how much they like themselves and if they are satisfied with their achievement, especially how they feel about society, education and family and to what extent their ideal self and actual self are close to each other (Uloko, 2019). Self-esteem is defined by Akpobia and Nidah, (2019) as the extension of values which the information within self-imagination has for a person and it comes from

persons belief about all the attributes and features presented in him. Self-imagination has a particular importance for mental health experts because the persons imagination about his personality to high degree determines his image about environment, and these two elements determines his behavioural forms (Lalifaz & Abbas, 2018). Self- esteem is the rate of validity, approval, acceptance and worthiness that a person feels about himself (Vanderzenden, 2018). A sense of self –valuation and self –esteem is a basic need to mental relief and is a need on which our life satisfaction is depended extremely.

Self-esteem is simply how a person feels about him/herself and how he/she judge him/her worth. Self-esteem is a very important aspect of self-development because it is the evaluation of one's competencies as it affects one emotional experience, future behaviour and long-term psychological adjustment. It has been observed that children with favourable self-esteem profiles tend to be well adjusted, sociable and conscientious (Sang, 2015). Self-esteem fluctuates as the child develops an overall view of themselves within the environment where they are growing up. A student with high self-esteem is more emotionally stable, mature and can handle lives' challenges than the adolescent with low self-esteem who tends to be more unstable and dependent.

Self-esteem has become a very important topic and researcher have been recently questioned the importance of the self – esteem and how people strive to get high and low self-esteem. There are many books publish to increase self-esteem and how to raise children with high-esteem to educate people about the importance of self-esteem. The researcher has defined self-esteem as cause to evil and good; depend on the balance of the self-esteem itself either high or low. Self-esteem has strong relation with happiness and low self-esteem will lead to depression. Children with low self-esteem seem to be more dependent on their parents and have lower academic achievement. However, this does not prevent children with higher self-esteem to be involved with social problem such as drinking and taking drugs. In general, self-esteem refers to how an individual value oneself based on feelings and self-evaluation thought. In academic achievement, self-esteem is considered in helping students view the capability to promote themselves through effort and goals. Common research has proven that the best way to enhance student's achievement is through improving self-esteem.

Self-esteem measurement and problems: There are several methods of classifying self-esteem instruments. Such as a) measures of self-regard or evaluation along specified dimensions, b) measures of configurationally properties of self-concept, and c) measures of the conscious self-concept, usually some evaluative aspects of it. Self-esteem has been measured in almost as many ways as there are of defining it. However, for simplicity, self-esteem measurement methods can be divided into the following two categories: a) self-report methods and b) observational methods.

Self-report methods: Self-report methods based on the subject's own responses can be given in a variety of forms. These methods are economical and practical in that they can be scored and interpreted easily, and the researcher can obtain a self-description from a subject in a short period of time because the measures are structured or semi-structured. Some possible problems with these methods would be fakebility, social desirability, response styles, and acquiescence. However, some of these problems can be controlled to some extent by, for example, using equal numbers of negative and positive statements, establishing rapport with the subjects, providing a non-threatening climate, and by assuring anonymity when administering the self-report instruments. Self-report methods can be further subdivided into the following four main categories:

Rating scales, which are the most common, although these may be prone to errors in central tendency, response set, and acquiescence. Other problems are in the differential meanings and ambiguity of trait names or scale units to the respondent.

Adjective check lists, which are commonly used with children because they relate more effectively to complete thoughts rather than isolated words (like names or adjectives) for describing themselves.

Semantic differentials, which employ categories on a continuum which separate a pair of dichotomous traits, though such a form necessitates the respondent making finer distinctions about himself which he may be unable to do. Fewer points are more likely to add only chance variance to the individual's judgement about oneself. Another problem is the ground which he can use if he does not care to respond on a particular item. The advantage of this form is that it provides both direction and intensity of response on a continuum between two terms which are opposite in meaning.

Q-sort, where the respondent sorts out statements which he/she perceives as ranging from least characteristic to most characteristic of themselves in a quasi-normal distribution of piles. Although the Q technique provides certain uniqueness in measurement, individuals may be grouped according to similarity in profiles but may be entirely different in personality structure. Cluster analysis using some type of distance function could be a possible answer to this problem. One obvious limitation of the Q sort is that the procedure is time consuming when a large number of subjects take part in a research study, because the sorting of statements is usually administered individually to each subject. Two other forms - open-ended questionnaires and pictorial or projective techniques - are also used occasionally. However, they both present particular problems of scoring and interpretation, and will not be described here.

Observational methods: Here, self-esteem is inferred from the individual's behaviour. The variety of this type ranges from the structured interview to the categorizing of behaviours by a clinically trained observer or the measuring of the perceptions of a third person, notably one or more of the significant other. Direct observations are useful for very young children, where self-report methods may be inappropriate for their age. However, the presence of the observer may produce behaviour on the part of the subject which could differ if the observer were not present. Finally, self-esteem may be inferred from the interaction of two or more types often by assessing the congruence between self-ratings and ratings of others.

In the context of this study, self-esteem is defined as the belief, perception and opinion individuals have about themselves which influences their behaviours and consequently affect their achievements in life. Self-esteem could be high or low. When individuals have high self-esteem, they tend to feel positive about themselves and about life in general. This in turn makes them become able to handle life's challenges better. However, when individuals' self-esteem is low, they tend to perceive themselves and issues of life in a more negative and critical light. A person with high self-esteem perceives himself as better, more capable and of greater worth than someone with low self-esteem. Generally, high self-esteem helps students to view themselves as active and capable persons to bring about changes through effort and set higher goals which enable them to learn new things. Zoller, and Gerard (2011), emphasized that the best way to improve students' academic achievement is to increase their self-esteem. In the same vein, Emeka, (2025), noted that, high self-esteem plays an important role in academic achievement, social and personal responsibility. In the light of the foregoing, this study aimed at determining the predictive value of self-esteem on academic achievement of secondary school students in Mathematics in Awka Education Zone of Anambra State

Research Questions

One research question guided the study.

1. What is the predictive value of self-esteem on academic achievement of students in Mathematics in secondary schools in Awka Education Zone of Anambra State?

Hypothesis

One null hypothesis was tested at 0.05 level of significance.

1. There is no significant prediction between self-esteem and academic achievement of secondary school students in Mathematics in Awka Education Zone of Anambra State.

Research Method

The study was carried out using correlational research design. It was conducted in the Awka Education Zone of Anambra state. The zone has a total population of 3,890 SSSII students. The population of male SSSII students is 1,692 while the population of SSSII female students is 2,198. (P.P.S.S.C. Headquarters, Awka. 2024). The sample of the study consisted of 300 senior secondary school students (SSII) drawn from the students' population in the zone. Stratified sampling technique was used to select subjects for this study. Simple random sampling technique was used in selecting Awka Education zone from the six education zones in Anambra State and selection of two secondary schools each from each stratum (Local Government Area) where this study was carried out. This brings the total number of schools for the study to six (6) schools. In stage two, simple random was used to obtain 50 students per school. This brought the total target sample size for the study to 300 students. The instruments for data collection were two questionnaires. The first instrument is the Rosenberg Self-Esteem Scale (Rosenberg, 1965), which contained 10-item statement and was structured with four-point scale of Strongly Agree (SA); Agree (A); Disagree (D); and Strongly Disagree (SD). The face and content validity of the instrument was ascertained by giving copies of it to two experts in the Faculty of Education, Nnamdi Azikiwe University Awka. For the Roseberg scale, it is already a widely-known and most utilized instrument for measuring self-esteem because it is standardized. Several Nigerian studies have utilized the instrument and found it consistently valid. The Roseberg Self-esteem Scale was deployed for use with a Cronbach Alpha reliability coefficient of 0.77 as determined by Rosenberg (1965). Other studies have also found it reliable at as high as 0.95. due to the closeness of the coefficient to the whole number 1, the instrument is regarded as reliable. The questionnaire was administered by the researcher with the aid of two research assistants and was through direct contact and completed copies were collected on the spot. The Pearson Product Moment Correlation was used to answer research question while regression analysis was used to determine the r^2 and adjusted r^2 . The co-efficient "r" obtained was used to ascertain how each of the independent variables predicted the dependent variable.

Following Best and Khan (2006), the research questions were interpreted using the real limit of numbers of:

1.01	-	0.39	weak prediction
0.40	-	0.59	Moderate prediction
0.60	-	0.99	Strong prediction

In interpreting the values of the null hypothesis, when p-value was less than or equal to 0.05 ($p \leq 0.05$), the null hypothesis was rejected. On the other hand, when the p-value was greater than

0.05 ($p > 0.05$), the null hypothesis was not rejected. The SPSS version 23 was used to analyze the data.

Results and Discussion

Research Question: What is the predictive value of self-esteem on academic achievement of students in Mathematics in secondary schools in Awka Education Zone of Anambra State?

Table 1: Pearson's Correlation Analysis of the predictive value of self-esteem on academic achievement in Mathematics of secondary school students in Awka Education Zone of Anambra State

Variables	N	Self-esteem	Academic Achievement in Mathematics	Remark
Self-esteem	1, 500	.387		
Academic Achievement in Mathematics	1, 500	.387	1	Low positive

As shown in Table 1, the analysis of the correlation between self-esteem and academic achievement of secondary school students in Mathematics in secondary schools in Anambra State gave an r of .387. The correlation coefficient (.387) is between .20 and .40 which shows a low positive predictive value of self-esteem on academic achievement of secondary school students in Mathematics in public secondary schools in Anambra State ($r = .387, n = 1, 500$). This indicates that self-esteem has a low positive predictive value on academic achievement of secondary school students in Mathematics in Awka Education Zone of Anambra State.

Testing of Hypothesis

1. **Hypothesis:** There is no significant prediction between self-esteem and academic achievement of secondary school students in Mathematics in Awka Education Zone of Anambra State.

Table 2: Test of Significance of Pearson's Analysis of the predictive value of self-esteem and academic achievement of secondary school students in Mathematics

Variables	N	Self-esteem	Academic Achievement in Mathematics	P value	Remark
Self-esteem	1, 500	1	-.006		
Academic Achievement in Mathematics	1, 500	-.006	1	.000	Not Significant

Data analysis presented on Table 2 indicates that Pearson product-moment correlation was run to determine the significance of the predictive value self-esteem and academic achievement of

secondary school students in Mathematics. The analyses yielded a predictive coefficient value of $-.006$ and p -value of $.000$. Since the p -value is greater than $.05$ ($.000 > .05$), the null hypothesis is not rejected, thus, self-esteem did not significantly predict academic achievement of secondary school students in Mathematics in secondary schools in Awka Education Zone of Anambra State.

Summary of Findings

The following findings emerged from this study:

1. Self-esteem has a low positive predictive value on academic achievement of secondary school students in Mathematics in secondary schools in Anambra State.
2. Self-esteem did not significantly predict academic achievement of secondary school students in Mathematics in secondary schools in Awka Education Zone of Anambra State.

Discussion of Findings

The result of the study showed that self-esteem has no significant predictive value on academic achievement of secondary school students in Mathematics in secondary schools in Awka Education Zone of Anambra State. Since the predictive value is not significant, it means an increase in level of self-esteem may not likely lead to increase in academic achievement of secondary school students in Mathematics in secondary schools in Awka Education Zone of Anambra State. This is because a student who perceives his or her self-esteem as low may likely achieve low in Mathematics, all things being equal. Again, enhancing students' self-esteem is among the instructional duties of teachers.

This result is in disagreement with the study of Osapa (2016) who found positive predictive value correlation value between self-esteem and academic achievement of secondary school students in Mathematics in secondary schools in Ondo State. Also, Marvel (2015) found that that self-esteem is positively and significantly related with the students' satisfaction. In the same vein, Bulue and Melhi (2015) found that the relationship between self-esteem and academic performance is high and self-esteem is an important predictor of academic performance.

Though, this study found that self-esteem has no significant predictive value on academic achievement of secondary school students in Mathematics in secondary schools, the study does not rule out that self-esteem has no predictive value on academic achievement of secondary school students in Mathematics in secondary schools. The point is that the prediction in Mathematics is not statistically significant. On this note, it is important to state that the importance of self-esteem in secondary schools cannot be over emphasized. In a school where students have high self-esteem, and adequate facilities are provided and effectively managed, it is most likely that the students in the school perform very well academically, all things being equal.

The findings also have implications for teachers' classroom management. Teachers, for instance can give the students the necessary support as a way of helping them to boost their self-esteem and achieve maximally. Finally, teachers need to note that it is not enough to supervise and monitor students' instructional activities as this cannot guarantee their devotion, dedication and commitment to high achievement in Mathematics. In this regard, unless students are given the impression that they are valued, they may not be intellectually and emotionally engaged with their studies. Hence, students need to be treated fairly in the classroom as this will boost their confidence and increase their academic achievement.

Conclusion

Based on the interpretations of the findings on the data collected and analysis and discussion of results, it is concluded that self-esteem has low positive predictive value on academic achievement of secondary school students in Mathematics in secondary schools in Anambra State. Finally, there is an indication that self-esteem did not significantly predict academic achievement of secondary school students in Mathematics in secondary schools in Awka Education Zone.

Recommendations

Based on the findings of this study, the following recommendations were made.

1. The government should set up special intervention programme geared at boosting the self-esteem of the students as this will improve academic achievement of secondary school students in Mathematics.
2. The principals should make conscious effort to formulate routine activities that will ensure high students' self-esteem to minimize low academic achievement of secondary school students in Mathematics.
3. As a way of ensuring increase in academic achievement of secondary school students in Mathematics in the secondary school, the teachers should allow the students to participate and voice their preferences and opinion during lessons.

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ARTIFICIAL INTELLIGENCE AND TEACHERS' PROFESSIONAL DEVELOPMENT: A PANACEA FOR SUSTAINABLE EDUCATION PRACTICES IN NIGERIA.

¹ **Nwodo Chizitelu Emmanuel**

Phone No. 08104733573

emmanuelchizy99@yahoo.com

² **Onwumbiko Agatha Nkechi**

Phone No. 07031623852

Na.onwumbiko@unizik.edu.ng

³ **Okonkwo Lilian Tochukwu**

Phone No. 07060968573

tochukwulilian@gmail.com

⁴ **Ezema Getrude Chinonso**

Phone No. 08133475676

gc.ezema@unizik.edu.ng

^{1,2,3 &4} **Nnamdi Azikiwe University Awka, Anambra State-Nigeria**

Abstract

The study examined the role of artificial intelligence (AI) in revolutionizing teachers' professional development as a vital solution for sustainable education practices in Nigeria. The integration of AI technologies holds the potential to enhance pedagogical approaches, personalize learning experiences, and facilitate efficient administrative processes. However, the effectiveness of AI in educational settings hinges on its contextual adaptation to Nigeria's unique socio-cultural and infrastructural challenges. Current professional development programs often lack coherence and relevance, resulting in a disconnect between educators' needs and the evolving educational landscape. This study argues that for AI to be a true panacea, it must be embedded within a comprehensive framework that prioritizes ethical considerations, teacher agency, and continuous professional growth. Tailored training initiatives are essential to equip educators with the digital literacy and adaptive teaching strategies required to effectively leverage AI tools. Moreover, addressing the digital divide and resource disparities is crucial for equitable access to quality professional development. By fostering a culture of collaboration and innovation, Nigeria can harness AI's capabilities to transform educational practices, ultimately improving learning outcomes for all students. This abstract advocates for sustained investment in human capital and strategic AI integration, emphasizing that technology should complement and enhance the human aspects of education. Through thoughtful implementation, AI can drive sustainable educational transformations in Nigeria, ensuring that all learners benefit from equitable and high-quality educational experiences.

Keywords: Artificial intelligence (AI), Teachers' professional development and Sustainable education practices

Introduction

The global educational landscape has undergone unprecedented transformation in the 21st century, fundamentally reshaping pedagogical approaches and professional development paradigms. Artificial intelligence (AI) has emerged as a revolutionary force that transcends traditional educational boundaries, compelling educators worldwide to reconceptualize their professional competencies and teaching methodologies. Oladipupo et al. (2024) contend that AI integration represents not merely a technological advancement but a paradigmatic shift demanding comprehensive professional development initiatives. However, critics argue that this technological determinism overlooks complex socio-cultural factors influencing educational transformation in developing contexts. Sustainable education practices encompass multifaceted approaches integrating environmental, social, and economic dimensions while fostering long-term educational quality and accessibility. Onyanabo (2024) asserts that Nigeria's educational context presents unique challenges necessitating contextually appropriate AI integration strategies, yet his analysis fails to adequately address institutional barriers impeding such integration. This underscores the critical need to examine how AI can catalyze professional development while acknowledging technology-centered approaches' limitations.

Nigeria's educational system faces significant challenges aligning with global technological advancements, particularly in AI integration. Oluwagbenro (2024) argues that despite growing recognition of AI's educational potential, numerous Nigerian institutions have yet to leverage these transformative technologies effectively, a claim warranting scrutiny given rapid technological adoption in urban centers. This technological lag underscores the urgent need for comprehensive professional development programs bridging traditional teaching methods and contemporary AI-enhanced pedagogical approaches. However, such assertions must be tempered by recognition of infrastructural and resource constraints characterizing Nigeria's educational landscape. Teachers' professional development represents a critical component of educational sustainability directly influencing instructional quality, student outcomes, and institutional effectiveness. Akomolafe et al. (2024) maintain that professional development in the AI era transcends conventional training models, requiring educators to develop technological literacy, adaptive teaching strategies, and innovative assessment techniques. While this observation captures professional development's evolving nature, it inadequately addresses resistance to change characterizing established educational institutions. Contemporary research emphasizes that effective professional development must be continuous, contextualized, and aligned with emerging technological trends.

Artificial intelligence has demonstrated profound influence on educational transformation through its capacity to personalize learning experiences, automate administrative tasks, and enhance pedagogical decision-making. Eze and Onah (2024) reveal that AI-powered platforms have revolutionized professional networking and knowledge sharing among educators globally, creating unprecedented opportunities for collaborative professional growth. Their findings indicate ChatGPT and chatbots are increasingly utilized in Nigerian universities for educational functions, yet their research fails to critically examine the quality and pedagogical appropriateness of such AI-mediated interactions. These platforms facilitate real-time collaboration and personalized learning experiences transcending geographical boundaries, enabling Nigerian educators to access global best practices.

The transformation of teachers' roles from traditional "knowledge transmitters" to "learning guides" and "skills trainers" represents a fundamental shift requiring extensive professional development support. This role evolution demands new competencies in digital literacy, data interpretation, and adaptive instruction developable only through sustained professional

development programs. Chukwunweolu et al. (2024) highlight ongoing challenges in Nigerian education, including teacher representation issues, complicating efforts to implement comprehensive professional development initiatives. Enemuo, Ezeanyi, and Ezeaka (2019) emphasize that machine learning represents a growing artificial intelligence research area, asserting future national prosperity will depend on information processing capabilities. However, their technological optimism fails to account for the digital divide characterizing Nigeria's educational landscape. This study seeks to critically address these identified gaps by rigorously investigating how AI technologies can revolutionize teachers' professional development practices in Nigeria, ultimately contributing to sustainable educational transformation. The research aims to critically examine the complex interplay between AI implementation and professional development outcomes, while challenging existing assumptions and providing evidence-based insights into effective strategies for leveraging AI as a panacea for sustainable education practices in Nigeria.

Conceptualization of AI and Teachers' Professional Development

Artificial Intelligence

Russell & Norvig, (2020), define Artificial Intelligence as a computational system that simulates human cognitive processes to perform complex tasks traditionally requiring human intelligenc. Likewise, Mitchell, 2019; Luckin et al., (2016), state that AI encompasses machine learning algorithms and data-driven technologies that enable automated decision-making and pattern recognition in educational contexts. Alongside other definition, Poole & Mackworth, 2017; VanLehn, (2011), define Artificial intelligence constitutes an interdisciplinary approach combining computer science, cognitive psychology, and educational theory to create intelligent systems capable of adaptive learning and problem-solving.

The study adopts the definition by Mitchell (2019) and Luckin et al. (2016), as the conceptual framework for the study. It states that artificial intelligence in education represents a sophisticated technological framework that integrates machine learning algorithms, natural language processing, and data analytics to enhance teaching methodologies, personalize learning experiences, and optimize educational outcomes through intelligent automation and decision support systems. Zhang et al. (2021) argue that AI transforms traditional educational paradigms by enabling adaptive learning environments that respond dynamically to individual student needs. However, Crompton & Burke (2023) contend that current AI applications remain limited in addressing complex pedagogical challenges that require nuanced human judgment. Despite technological advances, Ouyang & Jiao (2021) critically assert that AI systems lack the emotional intelligence and contextual understanding essential for effective educational practice. Nevertheless, Holmes et al. (2019) maintain that AI's capacity for data-driven insights revolutionizes educational assessment and intervention strategies, fundamentally reshaping how educators approach student learning and development.

Teachers' Professional Development

Guskey (2002) and Darling-Hammond et al. (2017) aver that teachers' professional development encompasses systematic learning opportunities designed to enhance pedagogical competencies, subject matter expertise, and classroom management skills throughout educators' careers. However, Desimone (2009) and Kennedy (2016) posit that professional development represents structured programs and experiences that enable teachers to acquire new knowledge, refine teaching practices, and adapt to evolving educational demands. Avalos (2011) and Borko (2004) state that teacher's professional development constitutes a continuous process of growth involving formal training, collaborative learning, and reflective practice aimed at improving instructional effectiveness

Teachers' professional development represents a comprehensive, ongoing process of capacity building that empowers educators to enhance their pedagogical expertise, integrate innovative technologies, and adapt to changing educational landscapes through structured learning experiences, collaborative inquiry, and reflective practice. Darling-Hammond et al. (2017) emphasize that effective professional development must be sustained, intensive, and directly connected to teachers' classroom practice. However, Guskey & Yoon (2009) challenge conventional approaches, arguing that many professional development programs fail to produce measurable improvements in student outcomes. Kennedy (2016) critically observes that traditional professional development models often lack coherence and fail to address teachers' specific contextual needs. Despite these criticisms, Desimone and Garet (2015) contend that well-designed professional development programs significantly impact teaching quality and student achievement when properly implemented and supported.

AI in Education

Artificial Intelligence in education represents a transformative paradigm that leverages computational technologies to revolutionize teaching, learning, and administrative processes within educational institutions. Roll and Wylie (2016) assert that AI applications in education encompass intelligent tutoring systems, adaptive learning platforms, automated assessment tools, and predictive analytics that enhance educational delivery and student outcomes. However, Zawacki-Richter et al. (2019) critically argue that current AI implementations often lack pedagogical grounding and fail to address fundamental educational challenges. The integration of AI technologies enables personalized learning experiences through sophisticated algorithms that analyze student performance data and adjust instructional content accordingly. Chen et al. (2020) contend that AI-powered educational systems demonstrate significant potential for addressing diverse learning needs and improving academic achievement. Nevertheless, Selwyn (2019) warns that uncritical adoption of AI technologies may exacerbate existing educational inequalities and undermine human-centered pedagogical approaches. AI applications include intelligent tutoring systems that provide individualized instruction, natural language processing tools for automated essay scoring, and machine learning algorithms for predictive modeling of student success. Luckin et al. (2016) emphasize that successful AI integration requires careful consideration of ethical implications, privacy concerns, and the preservation of human agency in educational decision-making. Despite technological promises, Holmes and Tuomi (2022) critically observe that AI systems must complement rather than replace human educators to maintain the essential relational aspects of effective teaching and learning.

Importance of Teachers' Professional Development in Nigeria

Teachers' professional development in Nigeria emerges as a critical imperative for addressing persistent educational challenges and improving learning outcomes across the nation's diverse educational landscape. Ajani (2019) argues that continuous professional development enables Nigerian teachers to acquire contemporary pedagogical skills necessary for effective classroom instruction. However, Afe (2006) critically observes that existing professional development programs often lack relevance to local contexts and fail to address systemic educational problems. The Nigerian educational system faces significant challenges including inadequate teacher preparation, limited resources, and outdated instructional methodologies that necessitate comprehensive professional development interventions. Adedoyin and Oyeniyi (2023) contend that structured professional development programs enhance teachers' competencies in curriculum delivery, assessment practices, and technology integration. Nevertheless, Ukeje (2020) warns that sporadic and poorly funded professional development initiatives yield minimal impact on educational quality. Professional development initiatives must address Nigeria's unique socio-cultural contexts while incorporating global best practices to ensure educational relevance and

effectiveness. Consequently, sustained investment in teachers' professional development represents a fundamental strategy for transforming Nigeria's educational system and achieving sustainable development goals.

AI Tools and Technology in Education

1. Intelligent Tutoring Systems (ITS)

Intelligent Tutoring Systems represent sophisticated AI-powered educational platforms that provide personalized instruction and immediate feedback to individual learners. Kulik and Fletcher (2016) established that ITS technologies adapt instructional content based on student performance data and learning preferences. These systems utilize machine learning algorithms to identify knowledge gaps and provide targeted remediation. VanLehn (2011) argues that ITS platforms demonstrate significant effectiveness in mathematics, science, and language learning domains. However, Nye et al. (2014) critically observe that current ITS implementations often lack emotional intelligence and fail to address complex learning dynamics. Despite technological advances, Graesser et al. (2018) contend that ITS systems require continuous refinement to match human tutoring effectiveness while maintaining scalability for diverse educational contexts.

2 Natural Language Processing (NLP) Tools

Natural Language Processing tools leverage computational linguistics to analyze, understand, and generate human language within educational contexts. Shermis & Burstein (2013) established that NLP technologies enable automated essay scoring, plagiarism detection, and language learning support. These tools utilize sophisticated algorithms to assess writing quality, provide feedback, and identify linguistic patterns. Zhang & Litman (2015) argue that NLP applications significantly enhance formative assessment and reduce grading burden for educators. However, Bereiter and Scardamalia (2016) critically warn that over-reliance on automated assessment may undermine critical thinking development and authentic evaluation practices. Despite limitations, Crossley et al. (2016) contend that NLP tools provide valuable insights into student writing development and support targeted instructional interventions when used judiciously.

3 Adaptive Learning Platforms

Adaptive Learning Platforms utilize AI algorithms to customize educational content and pacing according to individual student needs and performance patterns. Oxman et al. (2014) established that adaptive systems adjust difficulty levels, learning pathways, and instructional strategies based on real-time assessment data. These platforms employ machine learning techniques to optimize learning experiences and improve educational outcomes. Walkington and Bernacki (2020) argue that adaptive technologies demonstrate particular effectiveness in mathematics and science education through personalized problem-solving experiences. However, Reich and Mehta (2020) observe that adaptive platforms may constrain creative thinking and reduce opportunities for collaborative learning. Despite concerns, Pane et al. (2017) contend that well-designed adaptive systems enhance student engagement and achievement when integrated thoughtfully into broader instructional frameworks.

4 Predictive Analytics Systems

Predictive Analytics Systems employ machine learning algorithms to analyze educational data and forecast student outcomes, retention rates, and academic performance trends. Siemens and Long (2011) established that predictive analytics enable early identification of at-risk students and targeted intervention strategies. These systems process vast datasets including attendance records, assignment submissions, and assessment scores to generate actionable insights. Papamitsiou and Economides (2014) argue that predictive models support evidence-based decision-making and resource allocation in educational institutions. However, Prinsloo and Slade (2017) critically warn

about privacy concerns, algorithmic bias, and the potential for discriminatory practices in predictive systems. Despite ethical challenges, Macfadyen and Dawson (2010) contend that predictive analytics provide valuable tools for improving student success when implemented with appropriate safeguards and human oversight.

Benefits of AI-Driven Professional Development Programs

AI-driven professional development programs offer transformative opportunities for enhancing teacher competencies through personalized learning experiences and data-driven insights. Koehler et al. (2017) argue that AI technologies enable customized professional development pathways that adapt to individual teachers' needs, experience levels, and subject areas. These programs utilize machine learning algorithms to analyze teacher performance data and recommend targeted learning opportunities. Trust and Horrocks (2017) contend that AI-powered platforms provide continuous feedback and support, enabling teachers to develop competencies at their own pace while maintaining professional responsibilities. However, Ertmer and Ottenbreit-Leftwich (2010) critically observe that technology-mediated professional development may lack the human interaction and collaborative elements essential for meaningful professional growth. AI-driven systems offer significant advantages including scalability, accessibility, and cost-effectiveness compared to traditional professional development models. Reich and Mehta (2020) emphasize that AI technologies can democratize access to high-quality professional development resources, particularly for teachers in remote or underserved areas. Nevertheless, Darling-Hammond et al. (2017) warn that AI-driven programs must complement rather than replace human mentorship and collaborative learning communities. The integration of AI in professional development requires careful consideration of pedagogical principles, teacher agency, and the preservation of reflective practice. Ultimately, successful AI-driven professional development programs must balance technological efficiency with human-centered approaches to teacher learning and growth.

Challenges in Teacher Development in Nigeria

The challenges in teacher development in Nigeria include the following:

1 Inadequate Funding and Resource Allocation

Nigeria's teacher development programs suffer from chronic underfunding and inadequate resource allocation, limiting the scope and effectiveness of professional development initiatives. Afe (2006) established that insufficient government investment in education constrains opportunities for systematic teacher capacity building. Budget allocations for teacher training remain disproportionately low compared to infrastructure development and administrative costs. Adedoyin and Oyeniyi (2023) argue that resource limitations prevent access to contemporary teaching materials, technology, and training facilities necessary for effective professional development. However, Ukeje (2020) critically observes that available resources are often mismanaged and fail to reach intended beneficiaries. Despite policy commitments, Ajani (2019) contends that sustainable teacher development requires substantial financial investment and strategic resource management to achieve meaningful educational transformation.

2 Lack of Systematic Professional Development Framework

Nigerian teacher development lacks a coherent, systematic framework that ensures consistent quality and relevance across different educational contexts and regions. Oyebamiji and Adekola (2018) established that fragmented approaches to professional development result in uneven teacher competencies and inconsistent educational quality. The absence of standardized professional development standards creates disparities in teacher preparation and ongoing support. Akinwumi and Olarewaju (2021) argue that systematic frameworks are essential for aligning professional development with curriculum objectives and educational goals. However, Nwoke (2024) critically warns that centralized frameworks may fail to address local contexts and specific

regional challenges. Despite reform efforts, Dung et al. (2024) contend that establishing comprehensive professional development systems requires sustained policy commitment and institutional capacity building to ensure effective implementation and monitoring.

3 Limited Technology Infrastructure and Digital Literacy

Nigeria's teacher development faces significant challenges related to inadequate technology infrastructure and limited digital literacy among educators. Adebayo and Okwu (2020) established that poor internet connectivity, unreliable electricity supply, and limited access to digital devices constrain technology-enhanced professional development opportunities. Many teachers lack basic digital skills necessary for engaging with online learning platforms and educational technologies. Ogunniyi and Fashiku (2022) argue that digital literacy gaps prevent teachers from effectively integrating technology into their professional practice and student instruction. However, Ifeoma and Chukwuemeka (2019) critically observe that technology adoption without pedagogical training may result in superficial implementation and limited educational impact. Despite technological advances, Emeka et al. (2023) contend that bridging the digital divide requires comprehensive infrastructure development and sustained capacity building to ensure equitable access to technology-enhanced professional development.

AI as a Solution for Sustainable Education Practices

Artificial Intelligence emerges as a pivotal solution for achieving sustainable education practices by optimizing resource utilization, enhancing learning efficiency, and promoting equitable access to quality education across diverse contexts. Luckin et al. (2016) argue that AI technologies enable sustainable educational delivery through intelligent resource management, predictive analytics, and automated administrative processes that reduce operational costs while improving educational outcomes. AI-powered systems facilitate personalized learning experiences that maximize individual potential while minimizing resource waste through efficient content delivery and assessment mechanisms. Chen et al. (2020) contend that AI applications support sustainable development goals by democratizing access to high-quality educational resources, particularly for underserved populations and remote communities. However, Selwyn (2019) critically warns that AI implementation must consider environmental impacts, energy consumption, and digital equity concerns to ensure genuinely sustainable practices. The integration of AI in education promotes long-term sustainability through data-driven decision-making, predictive modeling for resource planning, and intelligent systems that adapt to changing educational needs. Holmes and Tuomi (2022) emphasize that AI technologies support sustainable teacher development through personalized professional learning platforms and intelligent mentoring systems. Nevertheless, Reich and Mehta (2020) caution that sustainable AI integration requires careful consideration of ethical implications, privacy protection, and the preservation of human-centered educational values. Ultimately, AI serves as a catalyst for sustainable education transformation when implemented thoughtfully within comprehensive frameworks that prioritize equity, efficiency, and environmental responsibility.

Conclusion

The integration of artificial intelligence into Nigeria's educational landscape is not merely a technological shift; it is a profound opportunity to redefine the very essence of teaching and learning. As this study has illuminated, AI has the potential to transform professional development, making it more personalized, adaptive, and impactful. However, the success of this transformation hinges on a critical understanding of the socio-cultural complexities that define Nigeria's educational context. By embracing AI, educators can foster an environment that not only enhances instructional quality but also bridges existing divides in educational access and equity. This dual approach—leveraging AI while remaining attuned to local needs—will empower

educators to become agents of change. It is essential to recognize that technology should enhance, not replace, the human elements of education; it should facilitate richer interactions and deeper learning experiences. Thus, as we stand on the brink of this educational revolution, we must advocate for a holistic integration of AI that prioritizes ethical considerations, cultural relevance, and sustained investment in human capital. Only then can we truly harness the transformative power of AI to create a sustainable and inclusive educational future for Nigeria.

Recommendations

1. Educational authorities should create tailored AI strategies that consider Nigeria's unique socio-cultural and infrastructural challenges, ensuring that AI tools are relevant and effective.
2. Educational authorities should implement comprehensive training programs aimed at improving educators' (teacher's) digital literacy, equipping them with the necessary skills to effectively leverage AI technologies in their teaching practices.
3. Educational authorities should prioritize funding for technology infrastructure in schools to ensure reliable access to AI tools and resources, enabling equitable opportunities for all educators and students.
4. Educational authorities should establish platforms for educators to share best practices and experiences regarding AI integration, promoting a culture of continuous professional growth and innovation in teaching methods.

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INFLUENCE OF ONLINE LEARNING ON COGNITIVE DEVELOPMENT OF BASIC EDUCATION PUPILS IN ONITSHA, ANAMBRA STATE

Dr. Emegwa Tina Uzoamaka

Department of Educational Management and Policy,
Nnamdi Azikiwe University, Awka, Anambra State, Nigeria
emegwauzuamaka@gmail.com

Abstract

This study examined the influence of online learning on cognitive development of basic education pupils in Onitsha South Local Government Area of Anambra State. Four research questions guided the study. Descriptive survey research design was adopted in this study. Population of the study comprised of 2209 primary 6 pupils in the 45 public basic education s in Onitsha South Local Government Area (ASUBED, 2024). The sample size was 150 primary six pupils selected through the use of simple random sampling technique. The research instrument for the study is a questionnaire titled “Influence of Online learning on Pupils Cognitive Development Questionnaire” (ISMPCDQ). The validated instrument contained three clusters with 20 items that sought information required to answer the research questions. The internal consistencies of the items in the clusters were determined using Cronbach Alpha Method and an overall coefficient of 0.76 was obtained. Data obtained was analyzed using mean. The findings revealed that online learning has negative influence on sensory motor development, pre-operational development, concrete operational development, formal operational development of basic education pupils in Onitsha South Local Government Area. Based on the findings of the study, it was recommended that parents, educators, and caregivers should set strict limits on online learning usage, designating screen-free zones and encouraging physical activity and outdoor play. This ensures pupils engage in activities promoting sensory integration, motor skills, and cognitive development.

Keywords: Online learning, Cognitive Development, Basic education, Sensory Motor Development, Pre-operational Development, Concrete Operational Development, Formal Operational Development

Introduction

Basic education, synonymous to primary education is a place where children's natural curiosity and enthusiasm for learning are nurtured and developed through a broad and balanced curriculum, preparing them for future success and lifelong learning. National Policy on Education (2013) posited that primary education is a kind of education given to children within the ages of 6-11 in an educational institution. Similarly, Oladimeji (2018) posited that basic education is an educational institution that provides foundational knowledge and skills to young children, preparing them for future learning. In the researcher's view, primary education is a school system in which children receives primary or elementary education from the age of about six to twelve, after preschool before secondary school.

The objectives of primary education as stipulated in NPE cited in Adebola (2019), includes: to inculcate permanent literacy and numeracy, and ability to communicate effectively; lay a sound basis for scientific and reflective thinking; give citizenship education as a basis for effective participation in and contribution to the life of the society; mould the character and develop sound attitude and morals in the child; develop in the child the ability to adapt to his changing environment; give the child opportunities for developing manipulative skills that will enable him

to function effectively in the society within the limits of his capacity; provide the child with basic tools for further educational advancement, including preparation for trades and crafts of the locality. Basic education /education is important to school children because it forms the foundation through which children build their literacy and numeracy. Through primary education, other developments of the child be it academic or otherwise takes effect. Teachers in basic education s make use of different technologies in content development. One of the technologies is the online learning.

Online learning refers to digital forms of communication technologies that enable the creation, dissemination, and interactive use of information and multimedia contents. Kaplan (2018) asserted that online learning is a group of internet-based applications that build on the ideological and technologies foundation that allows the creation exchange of user generated content. Nwankwo (2022), also defined online learning as websites and applications used for social networking. The researcher defines online learning as activities, practices, and behaviors among basic education pupils who gather online to share information, knowledge, and opinions using conversational media. According to Wilson (2021), popular online learning platforms familiar to basic education pupils includes: YouTube, TikTok, Instagram, Facebook, Snapchat, Roblox (gaming platform) and Minecraft (gaming platform). In addition, Offor, Anadi and Orizu (2017), posited that they use online learning to fit in with their friends and peers, to share their thoughts, feelings, and experiences, to access educational resources and online tutorials, to stay in touch with parents, teachers, and classmates, to explore and express their identity, to alleviate boredom and find something interesting, to follow influencers and celebrities. Nwankwo (2022) reported that basic education pupils use online learning for various reasons, including: to connect with friends, family, and classmates, to watch videos, play games, and enjoy online content, to explore and discover new things.

The use of online learning in basic education s has been a growing concern. This is because online learning has the potential to enhance learning, it also poses as a risk to children's safety and well-being. Positively, Adebayo (2021), posited that pupils could use online learning for educational activities such as online learning and collaboration with peers and teachers, for development of digital literacy and technical skills, access to information and knowledge sharing. On the negative aspect, the use of online learning according to Wilson (2021), could expose pupils to inappropriate content and online predators, cyberbullying and peer harassment, addiction and decreased physical activity. Wilson averred that it negatively impact on mental health and self-esteem, leads to distraction from academic work and decreased attention span, sharing personal information and privacy concerns, inappropriate online behavior and digital footprint. While it is believed that online learning can offer numerous benefits, excessive or unsupervised use of online learning can pose risks, such as affecting pupils' cognitive development.

Cognitive development fosters healthy cognitive growth and development in school children. It is referred to as the process by which children and adolescents develop the ability to think, reason, problem-solve, and understand the world around them. Nkwocha (2020) refer to cognitive development as the acquisition and refinement of cognitive skills such as: attention, memory, language, problem-solving, decision-making, reasoning, critical thinking, creativity executive functions (planning, organization, self-regulation) cognitive development is a lifelong process that begins in infancy and continues throughout childhood, adolescence, and adulthood. Sigelman and Rider (2022) define cognitive development as the study of how children acquire and refine their mental abilities, including perception, attention, memory, language, and problem-solving. It is shaped by a combination of genetic and environmental factors, including: genetics, family and culture, education, social interactions and life experiences (Akachukwu, 2021). Cognitive

development is crucial for children to: learn and understand new information, adapt to new situations, develop emotional intelligence, build social relationships, achieve academic success, develop independence and self-regulation, navigate complex cognitive tasks (Osuala, 2022).

Cognitive development is a crucial aspect of human growth, playing a significant role in shaping an individual's ability to learn, adapt, and succeed. According to Kuhl (2019), cognitive development is essential for building a strong foundation for future learning, as it enables individuals to develop critical thinking, problem-solving, and decision-making skills. Moreover, Goleman (2020) emphasized that the importance of cognitive development is that it cultivates emotional intelligence, social skills, and creativity, which are vital for personal and professional growth in the 21st century. The significance of cognitive development extends beyond academic achievement, as it also fosters social and emotional development, leading to better relationships and communication (Harris, 2018). Furthermore, cognitive development prepares individuals for an ever-changing, complex world, enabling them to navigate uncertain situations and make informed decisions (Dweck, 2017). By prioritizing cognitive development, individuals can be empowered to reach their full potential, leading to a more innovative, creative, and successful society.

The influence of online learning on the cognitive development of basic education pupils is a complex and multifaceted issue. While online learning has the potential to enhance learning and connectivity, excessive or inappropriate use can have negative effects on cognitive development. In this vein, Wilson (2021), posited that some possible influences include: distraction and decreased attention span, impact on language and communication skills, reduced critical thinking and problem-solving skills, exposure to inappropriate content: inappropriate or harmful content can negatively impact cognitive development and emotional well-being, sleep deprivation, social comparison and self-esteem, addiction and decreased physical activity, impact on social skills and relationships.

It appears that many basic education pupils do not use online learning platforms for academic purposes. Offor Anadi and Orissa (2017) posited that the rate at which basic education pupils devote their quality time chatting, calls for urgent attention because when they are not online, they dream of the comments and status they have received. The speed at which information is published on online learning has affected pupils spelling and writing. Hence, this reduces pupils' ability to effectively write without relying on computers spelling check features. Most basic education pupils lost interest in reading because they are addicted to online learning platforms (Adebola, 2019). On the contrary, some hard-working pupils become lazy as a result of so many friends they have in online learning; most basic education pupils were introduced to examination malpractice at online learning (Okenwa, 2021).

Another downside of online learning is that basic education pupils share too much information which may pose threats to them. Most of the information put on the online learning platforms is fake or half-truth (Johnson, 2019). They sometimes post misleading information. The pupils are getting addicted to the sites day by day and the number of users is on the increase. This proves that e-world is taking its toil over the real world. Some basic education pupils tend to have many friends but in reality, they are devoid of good friends. Pupils are becoming individualistic; social values are vanishing in Nigeria, irrespective of age (Nnatu, 2018). Most pupils start the day by checking their Facebook accounts.

Furthermore, Eze (2021) stressed that some other pupils cannot do without assessing their Facebook account within every hour. They like to stay update with the current trends and events

in the world of Facebook and other online learning like YouTube, TikTok, Instagram, Facebook, Snapchat, Roblox among others. The time and attention given to these online learning platforms seem to become increasingly alarming. Even at home, most of their times are spent watching or downloading online movies, responding to Facebook notifications, playing online games at the detriment of their studies (Offor, Anadi & Orissa, 2017). All these issues seem to influence the cognitive development of basic education pupils. It becomes needful to study the influence of online learning on cognitive development of basic education pupils in Onitsha South Local Government Area.

Statement of the Problem

Basic education pupils in Onitsha South Local Government Area seem to involve in the use of online learning at all time. The researcher observed that pupils who spend excessive time on online learning platforms are struggling to demonstrate basic comprehension skills, such as answering questions from a text material, and performing simple mathematical calculations. This trend suggests a potential decline in critical thinking and problem-solving abilities among pupils, which is alarming. On this ground, teachers and educators have expressed frustration with the lack of attention and engagement from pupils during lessons. Pupils seem more interested in their online learning feeds than in learning, leading to a significant drop in academic performance.

Despite the importance of addressing this issue, there has been a lack of concerted effort to mitigate the negative effects of online learning on pupils' cognitive development. While some educators and parents have warned about the dangers of excessive online learning use, their efforts have been largely anecdotal and ineffective. There has been no comprehensive study or intervention to understand the scope and severity of the problem, nor have there been any evidence-based strategies implemented to support pupils' academic performance and cognitive skills. As a result, the situation remains dire, with pupils continuing to struggle with basic academic tasks. It is therefore imperative that a thorough investigation is conducted to understand the influence of online learning on the cognitive development of basic education pupils in Onitsha South Local Government Area. On this premise the following research questions were posed:

1. What is the influence of online learning on sensory motor development of basic education pupils in Onitsha South Local Government Area?
2. What is the influence of online learning on pre operational development of basic education pupils in Onitsha South Local Government Area?
3. What is the influence of online learning on concrete operational development of basic education pupils in Onitsha South Local Government Area?
4. What is the influence of online learning on formal operational development of basic education pupils in Onitsha South Local Government Area?

Methodology

Descriptive survey research design was adopted in this study. Population of the study comprised of 2209 primary 6 pupils in the 45 public basic education s in Onitsha South Local Government Area (ASUBED, 2024). The sample size was 150 primary six pupils selected through the use of simple random sampling technique. The research instrument for the study is a questionnaire titled "Influence of Online learning on Pupils Cognitive Development Questionnaire" (ISMPCDQ). The instrument contained three clusters with 20 items that sought information required to answer the research questions. The validated instruments were structured on a four-point rating scale of Strongly Agree (SA) =4, Agree (A) =3, Disagree (D) =2 and Strongly Disagree (SD) =1. The internal consistencies of the items in the clusters were determined using Cronbach Alpha statistics.

The alpha coefficients got were 0.77, 0.74 and 0.79 for sections A, B and C respectively, with an overall coefficient of 0.76 and these were adjudged adequate, and the instrument reliable. Data obtained was analyzed using mean. A mean of 2.50 was used as the cutoff point for making decisions. The decision rule was that any item that scored a mean of 2.50 and above would be seen as having attracted positive responses and was agreed, while items that scored less than 2.50 is regarded as having attracted negative responses and was disagreed.

Results

Table 1: Mean rating of respondents on the influence of online learning on sensory motor development of basic education pupils in Onitsha South Local Government Area

S/N	QUESTIONNAIRE	4 SA	3 A	2 D	1 SD	F _x	$\bar{X}$	REMARKS
1.	Online learning hinders exploration among pupils	28 115	79 234	25 55	18 19	151 562	3.73	Agreed
2.	Exposing children to online learning at early stage improves their sensory integration	15 65	87 260	15 27	34 36	151 389	2.55	Agreed
3.	Children are at high risks of addiction when exposed to pictures on online learning	25 96	62 204	27 57	37 31	151 374	2.51	Agreed
4.	Exposing children to online learning decrease their attention to learning activities	46 174	48 148	35 63	29 27	151 414	2.72	Agreed
5.	Online learning hinders discovery among pupils	24 87	78 238	46 83	8 8	152 416	2.72	Agreed
6.	Online learning use by children reduces their opportunities to observe actions	26 119	78 232	29 56	19 19	156 561	3.75	Agreed
7.	Online learning use by children reduces their opportunities to mimic actions	23 87	72 214	29 41	52 52	151 403	2.65	Agreed
Mean of means							2.97	Agreed

In Table 1 items 1-7 including the cluster mean were rated 2.50, it shows that online learning has negative influence on sensory motor development of basic education pupils in Onitsha South Local Government Area.

Table 2: Mean rating of respondents on influence of online learning on pre operational development of basic education pupils in Onitsha South Local Government Area

S/N	QUESTIONNAIRE	4 SA	3 A	2 D	1 SD	F _x	$\bar{X}$	REMARKS
8.	Children exposed to online learning have less time for study	61 132	45 134	25 45	22 22	151 444	2.95	Agreed
9.	It reduces their mental imagery of the world around them	44 175	64 189	35 65	12 12	158 446	2.93	Agreed
10.	Exposing children to online learning does not prevent them from examining objects around them	48 187	72 216	18 31	13 17	159 452	3.00	Agreed
11.	When children listen to audio materials, they tend to mimic the sounds	36 147	80 240	22 44	16 15	151 441	2.95	Agreed
12.	Children would imitate the way an animal moves when they watch animal movies via their parents' phone.	21 87	71 213	28 46	59 54	151 401	2.67	Agreed
13.	Exposure to online learning reduces their chance of using words to describe and represent past events.	60 131	44 132	22 44	23 23	150 443	2.95	Agreed
Mean of means							2.90	Agreed

In Table 2, 6 items (8-13) had mean score of 2.50 and above indicating agreed by the respondents. This implies that online learning has negative influence on pre operational development of basic education pupils in Onitsha South Local Government Area.

Table 3: Mean rating of respondents on the influence of online learning on concrete operational development of basic education pupils in Onitsha South Local Government Area

S/N	QUESTIONNAIRE	4 SA	3 A	2 D	1 SD	F _x	$\bar{X}$	REMARKS
14.	Children tend to show decline in logical reasoning when exposed to much online learning funs	15 63	89 265	15 29	33 34	151 389	2.58	Agreed
15.	Children develops problem-solving skills when they are faced with online cheese games	23 91	68 202	25 53	33 35	151 378	2.51	Agreed
16.	Decreases spatial awareness among pupils	43 175	50 148	33 65	27 24	151 413	2.70	Agreed
17.	Decreases visual processing among pupils	21 87	80 238	41 81	9 9	151 414	2.75	Agreed
18.	Children's physical activities such as outdoor play is decreased when stocked with online learning games	30 123	90 268	14 27	18 18	153 430	2.87	Agreed
Mean of means							2.70	Agreed

In Table 3 above, items 16-18 obtained mean score of 3.50, 3.42, 3.42, 3.36, and 3.48 respectively indicating that they were agreed by the respondents, it shows that online learning has negative

influence on concrete operational development of basic education pupils in Onitsha South Local Government Area.

Table 4: Mean rating of respondents on influence of online learning on formal operational development of basic education pupils in Onitsha South Local Government Area

S/N	QUESTIONNAIRE	4 SA	3 A	2 D	1 SD	F _x	$\bar{X}$	REMARKS
19.	The use of online learning gives children the multiple ideas to analyze their environment	28 116	76 230	25 52	16 17	149 560	3.76	Agreed
20.	Excessive use of online learning does not give children room to evaluate their actions	17 63	88 263	15 27	34 31	151 386	2.59	Agreed
21.	Children choose google to solve academic problems more often than using it for online games	43 175	64 188	32 65	12 10	151 448	2.93	Agreed
22.	The use of facebook gives them insight on how to approach situations	15 63	89 265	15 29	37 36	151 387	2.59	Agreed
23.	WhatsApp is mostly used to communicate their teacher on solutions to certain concepts than fun with friends.	22 91	68 202	25 53	33 32	150 378	2.52	Agreed
24.	Hinders development of identity among pupils	22 87	72 214	22 45	55 55	156 405	2.67	Agreed
25.	Hinders development of self-concept among pupils	60 131	45 133	20 46	24 22	156 440	2.95	Agreed
Mean of means							2.86	Agreed

Data presented in Table 4 revealed that 7 items (8, 9, 10, 11, 12, 13, 14) had mean score of 2.50 and above indicating agreed by the respondents. It shows that online learning has negative influence on formal operational development of basic education pupils in Onitsha South Local Government Area

Discussion of Findings

The findings of the study revealed that online learning has negative influence on sensory motor development of basic education pupils in Onitsha South Local Government Area. According to a study by Ogbonna (2023), prolonged screen time is associated with delayed fine motor skills, hand-eye coordination, and balance. Similarly, a study by Ugwu (2022) found that children who spent more time on online learning exhibited poorer gross motor skills, including running, jumping, and throwing.

The findings of the study revealed that online learning has negative influence on pre operational development of basic education pupils in Onitsha South Local Government Area. Research by Okafor (2021) suggests that excessive screen time is linked to decreased attention span, working memory, and problem-solving skills. Moreover, a study by Johnson (2020) revealed that online learning use is associated with reduced creativity, imagination, and critical thinking skills in children.

The findings of the study revealed that online learning has negative influence on concrete operational development of basic education pupils in Onitsha South Local Government Area. A study by Ogbonna (2023) found that excessive online learning use is linked to decreased spatial awareness, visual-spatial skills, and mathematical problem-solving abilities. Furthermore, research by Ugwu (2022) revealed that online learning use is associated with reduced scientific literacy and critical thinking skills in children.

The findings of the study revealed that online learning has negative influence on formal operational development of basic education pupils in Onitsha South Local Government Area. The findings are consistent with the views of experts such as Jean Ogbonna (2023), who argues that excessive screen time is detrimental to children's cognitive, social, and emotional development. Similarly, Ogbonna (2023) notes that online learning use can lead to a lack of deep thinking and critical engagement.

Conclusion

Based on the findings of the study, it was concluded that the use of online learning has negative influence on cognitive development of basic education in Onitsha South Local Government Area.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Parents, educators, and caregivers should set strict limits on online learning usage, designating screen-free zones and encouraging physical activity and outdoor play. This ensures pupils engage in activities promoting sensory integration, motor skills, and cognitive development.
2. Secondly, promoting alternative activities and play is vital. Educators and parents should encourage engaging pursuits like arts and crafts, music, dance, sports, storytelling, and hands-on learning.
3. Schools should incorporate programs teaching responsible online learning use, online safety, and critical thinking skills. By doing so, pupils develop media literacy, online etiquette, and digital citizenship, empowering them to navigate the digital landscape effectively.
4. Parents and caregivers should prioritize face-to-face interaction, focusing on activities like reading, playing board games, cooking, and outdoor pursuits. This strengthens parent-child bonds, promotes emotional intelligence, and creates a balanced environment where children can thrive.

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PRINCIPALS' AWARENESS AND USE OF ARTIFICIAL INTELLIGENCE TOOLS FOR SCHOOL ADMINISTRATION IN SECONDARY SCHOOLS IN ANAMBRA STATE, NIGERIA

¹**Ekwurube Charity Adaobi**
ekwurubecharitym@gmail.com
+2348037373980

²**Dr Israel Chijiuka Oparaji**
ic.oparaji@Unizik.edu.ng
+2348106429025

^{1,2}Department of Educational Management and Policy,
Faculty of Education,
Nnamdi Azikiwe University, Awka, Nigeria

Abstract

The purpose of the study was to ascertain principals' awareness and use of AI tools for school administration in secondary schools in Anambra State. Survey research design was used for the study. The population of the study consisted of 266 principals of public secondary schools in Anambra State. No sampling was done given the manageable population. "Principals' Awareness of AI tools for School Administration Questionnaire (PAAITSAQ)" and "Principals' Use of AI tools for School Administration Questionnaire (PUAITSAQ)" were used for data collection. PAAITSAQ and PUAITSAQ were face-validated by three experts. The reliabilities of PAAITSAQ and PUAITSAQ were respectively ascertained using Kuder-Richardson-21 and Cronbach Alpha method respectively to yield scores of 0.3 and 0.74. Data were analyzed using frequencies, percentages, mean and standard deviation. The findings of the study revealed that majority of the principals were neither aware nor used AI tools for school administration in secondary schools in Anambra State, Nigeria. Based on the findings of the study, it was recommended among others that principals of public secondary schools in Anambra State, Nigeria should acquire the requisite digital literacy that will enable them use AI tools for school administration.

Keywords: Awareness, use, artificial intelligence, school and administration

Introduction

Secondary school is a vital part of education system in Nigeria that is saddled with the responsibility of preparing students for higher education. It is expected of principals to take secondary school administration with the seriousness that it deserves. School administration is the process by the administrative head, being the principal, applies principles and practices in such a manner that leads to the achievement of set out institutional goals. It involves the use of human and material resources to coordinate activities to realize school goals and objectives. School administration embodies the following: school planning, school organization, school control, co-ordination, performance-evaluation, decision-making, curriculum development and planning, school plant management, human capacity development, school-community relationship, academic calendar planning, school sport, school examination, extra-curriculum programme, school discipline programme, as well as school security (Ogunode & Gregory, 2025). It covers the effective arrangement of work schedules towards the optimization of school performance.

It is instructive to note that inspite of the relevance of school administration, there seems to be inefficiency in principals' school administration in Nigeria. Lending credence to the aforementioned assertion, Adelana and Akinyemi (2021) averred that Nigeria continues to be confronted with considerable inefficiencies in matters of administration, allocation of resources, students' performance tracking, and by extension, decision-making processes. This is in line with the observation of Igwe (2024) in Anambra State, Nigeria. It is rather worrisome that principals in 21st century still rely on error-prone manual processes for the discharge of their administrative tasks. Additionally, there appears to be the ubiquity of AI technologies even in smart phone devices that are accessible to principals of secondary schools. It is expected of principals in line with global trend to deploy technology such as artificial intelligence (AI) for ease of administration.

Artificial intelligence (AI) embodies the use of technology to do what is expected of human intelligence. It is a description of computer programmes that possess the capacity to undertake out sophisticated operations that were hitherto limited to human performance that cover thinking, problem-solving and decision-making (Ufot, 2024). In other words, artificial intelligence is expected to expedite or accelerate activities that would otherwise have slowed down using human intelligence. Similarly, Akpan and Clark (2024) noted that the aim of artificial intelligence is the enhancement of computer capabilities related to human comprehension, including language intelligence, reasoning, learning, and problem-solving. Deductively, artificial intelligence is tailored the use of technology to solve problems that otherwise would have been solved with human reasoning. Additionally, Ikechukwu (2024) defined artificial intelligence (AI) as the broad-spectrum of intelligence depicted by machines such as computer systems. Thus, the evolution of AI in education has brought about transformation of the sector. AI embodies certain technologies such as smart phone, search engines, internet as well as different applications (Southworth *et al*, 2023). AI tools that could be used by principals for school administration include: Brisk, Element451's Student Hub, Docupile, AI-powered Chatbots, Grammarly and ChatGPT, Civitas learning, BrightBytes and Tableau AI.

The evolution of Artificial Intelligence (AI) in school administration has provided novel opportunities for the enthronement of efficiency and precision in in administrative functions. Artificial Intelligence in education is continuously evolving. For example, AI technologies have been employed for the automation of request processing and considerable reduction of response times while giving room for staff to concentrate on strategic activities (Chen, Chen & Lin, 2020). Additionally, these technologies engender real-time data entry, provides solutions for scheduling and performance assessment in automated form. When adopted, AI-powered sensors as well as monitoring systems are capable of optimizing facilities management, including energy consumption and maintenance scheduling (Ugbenu *et al.*, 2025). Put differently, they reduce principals' workload as they concentrate on more strategic decision-making processes. Similarly, (Anguelov, 2021) pointed out that AI technologies reduce the possibility of human error while removing opacity in resource management. AI technologies ease the collection, processing and analysis of large volumes of data associated with students' progress and performance. Through data analysis, AI technologies will avail principals the insights to facilitate informed decision-making (Lampou, 2023). Additionally, AI tools are capable of compiling reports from real-time data with a view to bring about a reduction in the necessity of human intervention in time-consuming tasks (Tambuskar, 2022).

It is interesting to note that as relevant as AI tools are, they will not become relevant to principals in school administration if they are not aware of them. If they are not aware, it is not likely they will put them to use to ease administration. Apparently, while research works on teachers'

awareness and use of AI tools abound, there is paucity of research works on principals' awareness and use of AI tools for school administration. For instance, Cubio (2025) found that much as most administrators were conversant with AI tools, they were not frequently used except for chatbots in Philippines. Similarly, Zhang *et al.* (2021) noted that AI-powered chatbots and assistants were widely used in educational settings for their user-friendliness. For the teachers, Madu and Musa (2024) found moderate level of awareness of artificial intelligence (AI) among lecturers at the Faculty of Education. In contrast, Agbo *et al.* (2022) reported high level of awareness of AI among pre-service teachers in Ebonyi State while Amadi-Iwai *et al.* (2024) found low level of awareness and usage of AI among Business Educators in universities in the South-South region of Nigeria. Going further, Şherif *et al.* (2023) found very low level of teachers' usage of AI due to the fear that its usage could culminate in negative behaviors and practices that border on scientific research ethics. In view of the afore-mentioned contradictions and paucity of research works on principals' awareness and use of AI tools for school administration in secondary schools in Anambra State, the researcher considered the current study necessary.

Purpose of the Study

The study sought to determine:

- a) principals' awareness of AI tools for school administration in secondary schools in Anambra State; and
- b) principals' use of AI tools for school administration in secondary schools in Anambra State.

Research Questions

- i. Are principals aware of AI tools for school administration in secondary schools in Anambra State?
- ii. To what extent do principals use AI tools for school administration in secondary schools in Anambra State?

Methodology

The study utilized survey research design. Accordingly, Nworgu (2015) defined survey research design as one that involves a collection of opinions, attitudes or feelings of a population or its representative sample using questionnaire or interview to explain existing phenomenon. The appropriateness of the afore-mentioned design is based on the fact that the researcher sought to collect opinions of principals on their awareness and use of AI tools for school administration in Anambra State. The population of the study consisted of 266 principals in public secondary schools in Anambra State, Nigeria. No sampling was done as the population is of manageable size. Data were collected using two sets of questionnaires titled "Principals' Awareness of AI tools for School Administration Questionnaire (PAAITSAQ)" and "Principals' Use of AI tools for School Administration Questionnaire (PUAITSAQ)". PAAITSAQ and PUAITSAQ were developed by the researcher and consisted of 12 items apiece. While PAAITSAQ was constructed from literature in such a manner that the respondents responded by opting for one of the two response options of Yes/No, the respondents responded to PUAITSAQ by using one of four response categories of Very High Extent (VHE), High Extent (HE), Low Extent (LE) and Very Low Extent (VLE) with numerical indices of 4, 3, 2 and 1. PAAITSAQ and PUAITSAQ were face-validated by three experts in Faculty of Education, Nnamdi Azikiwe University, Awka. The reliability of PAAITSAQ was ascertained with KR-20 formular (Kuder-Richardson) after administering the PAAITSAQ to 15 principals with similar characteristics in Enugu State, Nigeria. In working out the reliability coefficient, each of the items was scored dichotomously, that is, when for each item, a mark is awarded for a correct answer and zero for a wrong answer. The reliability index of PAAITSAQ was found to be 0.83 and was considered high to confirm the

PTDCT as reliable. For PUAITSAQ, its reliability was ascertained using Cronbach alpha method. This was carried out by administering the PUAITSAQ to 15 principals with similar characteristics in Enugu State, Nigeria which is outside the study area. The internal consistency of the items in PUAITSAQ was determined using Cronbach statistics. The alpha coefficient obtained was 0.74. This was consistent with the stipulation of Shrestha (2021) that the adequate threshold value for Cronbach alpha should be >0.70 . Data collection was done with the aid of five research assistants who were co-postgraduate students. Out of 266 copies of PAAITSAQ and PUAITSAQ administered, 201 were recovered, indicating 75.56% return. Frequencies and percentages were used to analyze data from research question one. The cut-off point for accepting any item for research questions one is 50% thus the decision rule is that any percentage score of 50 or above was taken as aware while percentage scores below 50 were taken as not aware. Mean and standard deviation were used to answer research question two and to determine the homogeneity or otherwise of the respondents' views. The decision on the questionnaire items of research questions two was based on item and cluster means relative to real limits of numbers as shown below:

Response	Rating Scale	Real Limit of Numbers
VHE	4	3.50 – 4.00
HE	3	2.50 – 3.49
LE	2	1.50 – 2.49
VLE	1	1.00 – 1.49

Decisions on research questions two were based on the grand mean in relations to the real limits of numbers. The analysis was carried out using SPSS version 23.0.

Results

Table 1: Principals' Awareness of AI Tools for School Administration in Secondary Schools

	Aware		Not Aware		Decision
	Freq	%	Freq	%	
8. Brisk.	28	13.93	173	86.07	Not Aware
9. Element451's StudentHub.	17	8.46	184	91.54	Not Aware
10. Docupile.	13	6.47	188	93.53	Not Aware
11. AI-powered Chatbots.	108	53.73	93	46.27	Aware
12. Grammarly and ChatGPT.	102	50.75	99	49.25	Aware
13. Civitas learning.	31	15.42	170	84.58	Not Aware
14. BrightBytes.	45	21.43	156	78.57	Not Aware
15. Tableau AI.	59	29.35	142	70.65	Not Aware

Data in Table 1 show the frequency and percentages of principals' awareness of AI tools for school administration in secondary schools. It indicates that majority of the respondents are not aware of

the AI tools for school administration in secondary schools to the exception of AI-chatbots and grammarly and ChatGPT.

Table 2: Mean Ratings on the Extent of Principals' Use of AI tools for School Administration in Secondary Schools

	Mean	SD	Remark
1. Brisk.	1.97	.76	LE
2. Element451's StudentHub.	1.62	.42	LE
3. Docupile.	1.75	.53	LE
4. AI-powered Chatbots.	2.53	.96	HE
5. Grammarly and ChatGPT.	2.41	.83	LE
6. Civitas learning.	1.80	.66	LE
7. BrightBytes.	2.05	.81	LE
8. Tableau AI.	2.37	.75	LE
Grand Mean	2.06	.72	LE

The grand mean of 2.06 in Table 2 shows that the extent of principals' use of AI tools to a low extent for school administration. The analysis of the items shows that the respondents rated the use of all the eight AI tools by principals for school administration to be low. Their mean ratings ranged from 1.62 to 2.41.

Discussion

The finding of this study is that majority of the respondents were not aware of the AI tools for school administration in secondary schools to the exception of AI-chatbots, grammarly and ChatGPT. This shows that it is only AI-chatbots, grammarly and ChatGPT that public secondary school principals in Anambra State were aware of. In other words, they are not familiar with majority of the AI tools save AI-chatbots, grammarly and ChatGPT. This means that there is poor enlightenment from the Ministry of Education on the relevance of AI tools for school administration in secondary schools. This poor enlightenment could be traceable to the fact that the Ministry of Education have become so used to having the principals use their human intelligence for school administration that they see no need for enlightenment programmes tailored towards the digitalization of school administration. Amadi-Iwai *et al.* (2024) found low level of awareness and usage of AI among Business Educators in universities in the South-South region of Nigeria. This goes to show that principals and lecturers alike do not have sufficient enlightenment of AI tools. However, the finding of the study is contradicted by that of Cubio (2025) who found that most administrators were conversant with AI tools in Philippines. The foregoing contradiction may not be unconnected to sample characteristics in the disparate areas of the study.

The finding of this study is that majority of the respondents use AI tools for school administration in secondary schools to a low extent to the exception of AI-chatbots. This means that it is only AI-chatbots that is used to a high extent. Principals' poor usage of AI tools could be traceable to their attitude towards it. Put differently, it could be that they have become so accustomed to the use of their human intelligence for school administration that they have become unamenable to change or innovation. More so, it could be attributed to the fact that the principals do not possess the requisite digital literacy to use AI tools for school administration. Going further, principals' technology anxiety could be at the core of their poor usage of AI tools for school administration even when their students are digital natives. Corroborating the finding of the current study, Cubio

(2025) found that AI tools were not frequently used except for chatbots in Philippines. This is to say that the use of chatbots was given prominence for school administration. Similarly, Zhang *et al.* (2021) found that AI-powered chatbots and assistants were widely used in educational settings for their user-friendliness. This points to the fact principals have favourable disposition towards the use of AI-powered chatbots for administration.

Conclusion

The use of AI tools among principals for school administration can hardly be separated from their awareness of the AI tools. Based on the findings of the study, it was concluded that principals of public secondary schools in Anambra State were unaware of AI tools for school administration. It was further concluded that majority of the principals used AI tools to a low extent.

Recommendations

In line with the findings, the following recommendations were made:

1. Ministry of Education should conduct enlightenment programmes for principals of public secondary schools on the existence of AI tools for school administration in Anambra State, Nigeria.
2. Principals of public secondary schools in Anambra State, Nigeria should acquire the requisite digital literacy that will enable them use AI tools for school administration.

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ARTIFICIAL INTELLIGENCE, EDUCATION AND SUSTAINABLE DEVELOPMENT

Prof. Victor Antwi

University of Education, Winneba (UEW), Ghana)

Your Excellency, distinguished guests, respected colleagues, conference delegates, and fellow advocates of educational innovation, I am deeply honoured to stand before you today at the International Multidisciplinary Conference of the Education Dialogue Association hosted here at the University of Education, Winneba. The theme, “AI, Education and Sustainable Development,” is both timely and vital as we collectively grapple with one of the most profound transitions in the history of human learning, the integration of artificial intelligence into education systems across the globe.

The relevance of this theme lies in its ability to unite two transformative forces: technological advancement and the enduring mission of education. Artificial intelligence, once relegated to the pages of science fiction, is now embedded in our everyday reality, shaping how we live, work, communicate, and most importantly, how we learn. At the same time, the global push toward sustainable development, embodied in the United Nations’ Sustainable Development Goals, particularly Goal 4 on inclusive and equitable quality education, compels us to rethink our educational practices in light of social justice, equity, and long-term planetary wellbeing.

In the current era, AI presents immense possibilities for improving educational access, personalization, and efficiency. Global examples abound. In China, adaptive learning platforms such as Squirrel AI use real-time analytics to diagnose student learning gaps and provide tailored content, improving performance across socioeconomic strata. In Finland, the nationwide “Elements of AI” initiative has democratized access to AI education, training citizens across all sectors in basic concepts to foster a future-ready population. And in the United States, institutions like Georgia Tech have deployed AI teaching assistants such as “Jill Watson,” dramatically improving responsiveness and learning support in online courses (Veluchamy, 2025).

These examples underscore the transformative potential of AI to promote personalized learning, facilitate student support, and augment teacher capacity. Yet, they also raise critical questions. Can AI replace the human elements of education, empathy, mentorship and ethical reasoning? How do we ensure that AI tools do not perpetuate existing biases or deepen inequalities, particularly in resource-limited contexts?

In Africa, the story is evolving. Countries such as Kenya, Rwanda, and South Africa have begun integrating AI in educational innovation through smart classrooms, AI-driven learning management systems, and national AI strategies. Rwanda’s Vision 2050 includes AI in its STEM education goals, while South Africa’s universities are experimenting with AI in early-warning systems to identify students at risk of dropping out. However, the African context presents unique challenges. As of 2023, internet penetration across the continent remains uneven, with large disparities between urban and rural access. Moreover, the AI literacy gap among teachers and administrators remains significant, creating a risk of technological dependency without understanding (Pedro et al., 2019).

In Ghana, we find ourselves at a critical juncture. Pilot initiatives are emerging. Some tertiary institutions, including UEW, have explored AI-based writing feedback tools, intelligent tutoring systems, and data analytics for learner tracking. At the national level, discussions are ongoing

about building a framework for ethical AI deployment in education. Yet, systemic challenges remain: insufficient infrastructure in rural schools, limited teacher training in AI, low digital literacy among students, and inadequate policy guidance on AI use and governance.

To ensure that AI contributes meaningfully to sustainable development in Ghana's education sector, we must adopt a multi-dimensional approach. First, policy formulation must be prioritized. We need clear, context-sensitive national and institutional frameworks to guide the ethical use of AI in education, frameworks that promote transparency, data privacy, and accountability while advancing inclusion and equity. Without this, we risk importing systems that are culturally alien and structurally unfit for our learning environments.

Second, teacher professional development is paramount. The introduction of AI in the classroom should not be seen as replacing teachers but empowering them. This means investing in training programs that equip educators with the skills to integrate AI tools into pedagogy meaningfully and responsibly. As Tedre et al. (2021) rightly emphasises, teachers must remain central to the learning process, even as AI automates routine functions.

Third, curriculum reform must be pursued to reflect a future-oriented learning paradigm. AI should be both a tool and a topic of learning. Ghanaian learners at all levels should be introduced to foundational AI literacy, not merely as consumers of technology but as potential creators and ethical agents. This requires us to redesign curricula to include computational thinking, ethics of AI, and interdisciplinary applications in agriculture, health, and environmental sustainability.

Fourth, the issue of access must be treated as a matter of justice. AI must not become the new face of inequality. We must design solutions that are inclusive of rural learners, students with disabilities, and underprivileged communities. This includes ensuring availability of low-data AI tools, offline-capable platforms, and multilingual user interfaces that reflect Ghana's linguistic diversity.

Finally, AI integration in education must be aligned with broader sustainable development objectives. Artificial intelligence can help optimize energy use in schools, personalize environmental education and analyse data for evidence-based education planning. AI must not exist in a silo but rather support the holistic development of human and ecological systems.

As we deliberate in this conference, let us remind ourselves that while AI is a powerful enabler, it is not a silver bullet. It cannot substitute for political will, ethical leadership, inclusive policies, or a vision of education that is rooted in human dignity. We must strive to ensure that the deployment of AI does not reinforce colonial models of knowledge but rather serves to amplify African innovation, language, identity, and resilience.

In closing, let me echo the sentiments of educational futurist Sir Ken Robinson, who once said, "The fact that you're a teacher doesn't mean you know the answer; it means you can ask the right questions." Today, AI offers us new tools, but it is still up to us to ask the right questions, about equity, about values, about what kind of future we want for our children. Let this conference be a call to action. Let Ghana not just adopt AI but help shape it, ethically, contextually, and boldly.

Thank you for your attention, and I look forward to the insights this gathering will yield for the future of education and sustainable development.

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INFLUENCE OF TEACHERS' MOTIVATION AND STUDENTS' ACADEMIC PERFORMANCE: A STUDY OF SECONDARY SCHOOLS IN ENUGU STATE, NIGERIA

¹Rebecca Ebonam Chikendu (Ph.D) & ²John Amaoge Wordu (Ph.D);

¹Department of Science Education
Faculty of Education
Nnamdi Azikiwe University, Awka

²Department of Educational Management
Faculty of Education, Rivers State University
Nkpolu Oroworukwo, Port Harcourt

Emails: ¹re.chikendu@unizik.edu.ng ²john.wordu2@ust.edu.ng,

Phone Nos: +2347038934222 +2348037512872

Abstract

This study determined how teacher's motivation impacted on students' academic performance in secondary schools in Oji-River L.G.A. of Enugu State, Nigeria. Survey research design was adopted. Data were generated from the questionnaires administered to the respondents. The hypotheses were tested using Pearson correlation coefficient via SPSS 20. From the analysis and the hypotheses tested, it was revealed that there is a significant relationship between prompt teachers' promotion and academic performance in secondary schools in Oji-River L.G.A. of Enugu State. There is a significant relationship between regular payment of teachers' salary and academic performance of secondary school students in Oji-River L.G.A. of Enugu State. Based on the findings, it was recommended that the school management bodies have been advised to work with the Ministry of Education to ensure prompt and regular payment of teachers' salaries also ensure salary increase and competitive teachers' welfare.

Keywords: Prompt teacher's promotion, regular payment of teacher's salary and academic performance

Introduction

The concept of motivation is considered a decisive factor that influences human behaviour and performance. Motivation is a very important psychological concept that helps an individual to constantly strive to achieve a goal. Motivation is the inner desire of an individual to succeed in what he does. Motivation is a positive change in mental and physical activity aimed at achievement. Shameena (2009) states that motivation can be defined as an active force in people that compels them to move forward and act to realize projected desires and opportunities. According to Ibok (2020), motivation has two components: intrinsic and extrinsic values.

Motivation is of particular interest to educational psychologists because it plays a crucial role in student learning. However, special motivation that is studied in the special environment of education is qualitatively different from the more general forms of motivation studied by psychologists in other fields. Educational motivation can have some effects on how students learn and how they behave towards a subject (Cerdan, 2017). It can direct behaviour toward specific goals, lead to greater effort and energy, increase activity and persistence, improve cognitive processing, determine which consequences are reinforced, and lead to improved performance.

Teachers are the main factors in shaping the functioning of the teaching and learning environment; their only job is to motivate students to learn. It is assumed that teachers differ in how they motivate students to learn, and their motivational strategies differ from person to person (Hornstra, Majoor & Peetsma, 2017). In the 1950s and late 1960s, teachers were respected among other professionals. However, Imo (2013) pointed out that in our current Nigeria, the motivation given to teachers is not given sufficient priority. Teachers at all levels of education system should be adequately trained, respected, paid and empowered to participate in decisions affecting their working life and learning environment. Teachers' motivation has a unique place in the entire educational system and it is absolutely appropriate to pay visible attention to it. If teachers can do their jobs effectively, their students can learn effectively. According to Han and Yin (2016), teachers are not motivated to work because they face unfavorable work environment, poor management, inadequate career structure, repetitive teaching, low external value such as low salary, and less opportunities for research. Lack of motivation for teachers has negative consequences for the educational level of the society. Kihara, Kimiti and James (2018) affirm that lack of motivation negatively affects the educational level of the school. They add that if students are deprived of the knowledge they need to succeed academically, they would be less motivated. Problems related to the motivation of teachers with negative attitudes lead to students' dropout. Dropouts may face overwhelming challenges in the labour market and may also engage in crime and other social vices such as armed robbery, cultism, cybercrime, prostitution, drug addiction and many others.

There are different strategies to motivate a teacher to work effectively. Ibok (2020) states that motivational strategies such as regular salary payment and regular promotion of teachers ensure teaching effectiveness and also lead to student academic success. Belyh (2020) explains regular promotion where an employee moves from one position to another. Belyh concludes that regular promotion is a positive way for employers to motivate their employees. The findings of Ndijuye and Tandika (2019) showed that achieving holistic development of students is primarily the responsibility of teachers and depends only on timely promotion and other motivational factors. Udoh (2013) and Egbe (2014) also argued that regular payment of teachers' salaries is the best way to attract the interest of those teachers. The conditions of service of the teachers are constantly being improved. This draws attention to the need to study some motivational variables that neutralize or eventually eliminate teacher fatigue.

Ibok (2020) believes that what makes a job satisfactory or unsatisfactory does not depend only on the nature of the job. It also depends on the motivation of the employees, which of course is also the reason for the choice of workplace. Mathematics teachers prefer other tasks to teaching, not because of the nature of the work but because of motivational strategies. Regular promotion is another variable that tells about the movement of an employee from one position to another. Regular promotion is a positive way for employers to reward their employees. This is a variable that can motivate or demotivate teachers to stay or leave their jobs. Elevation comes with job promotion, job promotion comes with higher salaries, and higher salaries are associated with changes in status and prestige (Ibok, 2020).

The status and prestige of teachers change when they are promoted and they receive reasonable benefits from that promotion. It can also be the best way to stimulate their interest as well as those who want to enter the teaching profession (Egbe, 2014). A teacher's regular salary payment may be the only incentive that can increase a teacher's productivity. Regular payment of teachers' salary gives teachers an impetus or incentive to achieve better results. According to Trase and Lanry (2012), money (salary) was recognized as the most important source in meeting the needs of employees; therefore, money not only satisfies psychological needs, but also provides security

and social needs. Their study reported that high school students consistently performed poorly in state examinations for about eight to ten years. This problem already reported by Trase and Lanry (2012) necessitated the current researchers' exploration of approaches to improve teachers' performance at the secondary school level.

The idea behind this research was that every student has a potential, and teachers should realize this and motivate them. Figuring out what is important to teachers and the best ways to inspire them to do better on time is difficult. According to research and experience, teachers tend to emphasize intrinsic rewards such as self-esteem, responsibility and a sense of accomplishment. Without intrinsic motivation, failure is inevitable. Teacher's production decreases dramatically if not driven by others. In terms of motivation and job satisfaction, it is clear that intrinsic rewards outweigh extrinsic rewards for supervisors. This has compelled the current researchers to conduct research to determine how motivation of teachers impacted on students' academic performance in Oji Urban secondary schools, Oji-River L.G.A. of Enugu State.

H₀₁: There is no significant relationship between prompt teacher's promotion and academic performance of secondary school students in Oji-River L.G.A. of Enugu State.

H₀₂: There is no significant relationship between regular payment of teacher's salary and academic performance of secondary school students in Oji-River L.G.A. of Enugu State.

Literature Review

Different authors have seen academic success in different ways. Ifeakor (2012) considers academic achievement as a change in behaviour at the end of a period or within a period of time. Aronson (2010) defines academic success as the performance of students in schools, colleges and universities or in field work to which the student is sufficiently exposed. Williams (2018) suggests that when academic success is discussed, it is often associated with students' academic achievements and abilities, impressive test scores, extracurricular achievements, and students' ability to lead when assigned. Ballotpedia (2019) defines academic achievement as a measure of how well students succeed in various subjects. Academic performance enables us to obtain information on the extent to which a student has attained the criterion performance. It also enables us to determine the relative position or rank of individual student with respect to their performance (Etuk, Koko and Eno, 2017).

Poor academic performance is a performance that does not meet standards. Poor academic performance is any performance that cannot meet targets, adequate standards and expectations or desires (David, 2018). Poor academic performance refers to the termination of effort caused by fear of doing something (Al- Zoubi and Younes, 2020). The student is still trying to achieve his goal but is unable to achieve it. Similarly, according to Siqueira and GurGe-Giannetti (2017), poor academic performance can also be interpreted as a result of lower expectations and a lack of cognitive skills.

According to Omebe (2010), motivation consists of tangible things such as bonus payment and regular promotion which may of course mean a raise in salary, leading to attainment of personal intangible altitudes such as recognition, prestige, power, and so on. Regular payment of teachers' salaries fuels teachers' zeal for better performance. According to Joshua (2008), paying teachers regularly motivates them to work harder, which increases productivity and efficiency. Ubom (2013) found that there is a significant relationship between the regular payment of teacher's salary and the academic performance of students. Similarly, Ekpenyong (2016) found that regular payment of teachers' salaries significantly affects student performance.

Turyatunga, Kaziro, Ariyo, Kobusingye and Kamugisha (2023) investigated the effect of teacher motivation on student academic achievement using a case study in Alito District, Kole District, Northern Uganda. After evaluating the primary data, a linear model was used for estimation. Kkurtosis was used in descriptive analysis (K). As attributes were hypothesized, stationarity checks were performed using unit root tests as a preliminary data pretest. If the data are serial correlations, a long-term and short-term relationship between the variables was established to suggest a policy for Kole district of Uganda. In addition, tests of multicollinearity, tests of heteroskedasticity and tests of autocorrelation were used. The research revealed that there is a significant relationship between teachers' motivation and students' academic success. Mohammed and Abdulai (2022) investigated the factors affecting teacher motivation in secondary schools in Elliotdale Circuit. The research method was qualitative. The findings revealed inadequate support materials for teachers and students in schools, non-payment of temporary teachers' salaries, lack of access roads to and from schools, lack of safe accommodation for teachers, poverty and lack of electricity and water supply in some schools influence the job satisfaction and motivation of secondary school teachers.

Igoche, Ogugua and Takor (2022) adopt a descriptive survey study to investigate the effect of teacher motivation on students' mathematical performance in secondary schools in Okpokwu Local Government Area of Benue State, Nigeria. The results showed that teachers' service conditions affect students' performance in mathematics in Okpokwu LGA, Benue State, Nigeria. The result also showed that the professional upward mobility of teachers (promotion) affects the results of students in mathematics. The results showed that teacher motivation can improve students' academic achievement in mathematics in Okpokwu LGA, Benue State, Nigeria.

Also, Oba-Adenuga (2022) investigated the motivational counselling of teachers of secondary school students in Abeokuta South Local Government Area of Ogun State, Nigeria. Samples of 15 teachers and 180 students were used in the study. Data were tested using Pearson's correlation coefficient and tested at a significance level of 0.05. The result of this study shows a significant relationship between teachers' motivation and students' academic performance. The result also shows a significant relationship between teachers' motivational strategies and students' academic performance. Finally, the result shows a significant relationship between the tenure of teachers and academic performance.

Ubo (2013) conducted a study on teacher motivation and student performance in secondary schools in Okobo Local Government Area of Akwa Ibom State. The study used a survey research design. A sample of 100 teachers was randomly selected for the study. The data collection tool was a structured questionnaire. The result of chi-square analysis shows that there is a significant relationship between regular salary payment of teachers in Okobo Local Government Area and academic performance of students among other variables. Ocho (2012) conducted a study on the effect of motivational variables on students' academic performance among secondary school teachers in Uyo Local Government Area, Akwa Ibom State. To achieve this, three hypotheses were formulated and tested at the 0.05 alpha level. The design of the study was a survey. The sample of the study consisted of all biology teachers randomly selected from secondary schools in Uyo Local Government Area of Akwa Ibom State. The sample was selected using stratified and simple random sampling. The instrument used in this study was an adapted 15-item 4-choice rating scale questionnaire. The reliability of the device was tested by the test-retest method, which gave an index of 0.68 to 0.82. Collected data were statistically analyzed using an independent t-test. The obtained results showed, among other things, that a good service condition has a significant impact on the academic success of students of state secondary school teachers. Similar to the work of Ocho (2012), this study seeks to investigate the effect of teacher motivation on student

academic performance in secondary schools. However, this study focuses specifically on students' mathematical performance. Furthermore, Ocho's study was conducted in Uyo LGA, Akwa Ibom State, which is not within the geographical scope of this study.

Methodology

Study Design

The study made use of correlational survey research design. This research design is appropriate for this study because it is the most suitable tool to use when the research is aimed at identifying characteristics, frequencies, trends and categories.

Population and sample Size

The simple random sampling technique was used to enable the researcher gather data that can be generalized on the entire population. However, for the purpose of effective representation of the population in the study, the researcher used 50% of the population (9 secondary schools) for the sample size of which each school was allocated 5 teachers and 15 students each from each of the 9 secondary schools in Oji-River L.G.A. of Enugu State. The total number of the respondents' is 180

Sources of Data Collection

This study sourced data from primary source. Primary data were obtained from the respondents of the selected population through the structured questionnaire administered to the respondents.

Method of Data Collection

Data were collected by means of survey using copies of structured questionnaire as research instrument. The instrument was coded in five-point Likert rating scale format as follows; Strongly Agree (5), Agree (4), Undecided (3), Disagree (2), and Strongly Disagree (1). The questionnaire dealt with essential issues concerning relationship between teachers' motivation and student academic performance of secondary schools.

Method of Data Analysis

In testing the hypotheses formulated, data were analyzed using Pearson's Product Moment Correlation Coefficient at 0.05 level of significance with aid of Statistical Package for Social Sciences (SPSS), version 20.0. This method was adopted so as to ascertain the strength of the relationship, patterns, significant connections, and trends between the variables in the hypotheses. Mathematical formula for Correlation Coefficient is stated as;

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{[N\sum x^2 - (\sum x)^2][N\sum y^2 - (\sum y)^2]}}$$

Where:

N	= number of pairs of scores
$\sum xy$	= Sum of the products of paired scores
$\sum x$	= Sum of x scores
$\sum y$	= Sum of y scores
$\sum x^2$	= Sum of squared x scores
$\sum y^2$	= Sum of squared y scores

Decision rule:

Accept the alternative hypothesis when the probability value (p-value) is less than alpha value of 0.05, otherwise reject.

Data Analysis**Table 4.1: Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ACP	5	12.00	344.00	133.8000	140.13815	.899	.913	-.215	2.000
PTP	5	9.00	340.00	133.8000	138.95395	.831	.913	-.376	2.000
RPS	5	9.00	330.00	133.8000	136.13486	.663	.913	-.795	2.000
Valid N (listwise)	5								

Source: SPSS 20.0 output, 2023

Interpretation

The descriptive statistics for the independent variables are prompt teacher's promotion (PTP), and regular payment of teacher's salary (RPS) and the dependent variable; academic performance (ACP), was represented in Table 4.1. The mean is used to establish a baseline. The maximum and minimum numbers, on the other hand, aid in the detection of data problems. The variation from the mean is represented by the standard deviation. It is a risk indicator; the greater the standard deviation, the greater the risk. The standard deviation is a metric that expresses how much each item in a dataset deviates from the mean. It is the most reliable and extensively used metric. The standard deviations in the firms are 140.14, 138.95 and 136.13, for ACP, PTP, and RPS respectively.

Test of Hypotheses**Hypothesis One**

H₀₁: There is no significant relationship between prompt teacher's promotion and academic performance of secondary school students in Oji-River L.G.A. of Enugu State.

Table 4.2: Correlations

		PTP	ACP
ACC	Pearson Correlation	1	.997**
	Sig. (2-tailed)		.000
	N	5	5
EMC	Pearson Correlation	.997**	1
	Sig. (2-tailed)	.000	
	N	5	5

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4.2 above, correlation coefficient of 0.997 a positive correlation between prompt teacher's promotion and academic performance of secondary school students. To get an idea of how much variance the two variables share, the coefficient of determination (R) is calculated. R is 0.997 x 0.997= 0. 994. It implies that prompt teacher's promotion helps to explain 99% of the variance in

academic performance of secondary school students in Oji-River L.G.A. of Enugu State. From the above result, the study discovers that the confidence level between prompt teacher's promotion and academic performance is very high, and that correlation coefficient is significant at 0.01 levels. Therefore, reject null hypothesis and accept alternate hypothesis which stated that there is a significant relationship between prompt teacher's promotion and academic performance of secondary school students in Oji-River L.G.A. of Enugu State.

Hypothesis Two

H₀₂: There is no significant relationship between regular payment of teachers' salary and academic performance of secondary school students in Oji-River L.G.A. of Enugu State.

Table 4.3: Correlations

		RPS	ACP
REC	Pearson Correlation	1	1.000**
	Sig. (2-tailed)		.000
	N	5	5
JBS	Pearson Correlation	1.000**	1
	Sig. (2-tailed)	.000	
	N	5	5

** . Correlation is significant at the 0.01 level (2-tailed).

Indeed, from the above figure, correlation coefficient of 1.000 shows a positive correlation of regular payment of teachers' salary and academic performance. To get an idea of how much variance the two variables share, the coefficient of determination (R) is calculated. $R = 1.000 \times 1.000 = 1$. It implies that regular payment of teacher's salary helps to explain 100% of the variance in regular payment of teacher's salary and academic performance of secondary school students in Oji-River L.G.A. of Enugu State. From the above result, the study discovers that the confidence level between regular payment of teacher's salary and academic performance is very high, and that correlation coefficient is significant at 0.01 levels ($.000 < 0.01$). Therefore, reject null hypothesis and accept alternate hypothesis which states that there is a significant relationship between regular payment of teachers' salary and academic performance of secondary school students in Oji-River L.G.A. of Enugu State.

Discussion and Conclusion

From the analysis and the hypotheses tested, it was revealed that there is a significant relationship between prompt teacher's promotion and academic performance of secondary school students in Oji-River L.G.A. of Enugu State. There is a significant relationship between regular payment of teachers' salary and academic performance of secondary school students in Oji-River L.G.A. of Enugu State. This result is in confirmation with Turyatunga, Kaziro, Ariyo, Kobusingye and Kamugisha (2023). The study revealed that there is a significant relationship between teacher's motivation on academic performance of students. Igoche, Ogugua and Takor (2022) show that with teachers' motivation, the students' academic performance in mathematics can be enhanced in Okpokwu LGA, Benue State, Nigeria. The findings of Oba-Adenuga (2022) also reveal a significant relationship between condition of service of teachers and academic performance of students.

Conclusion

The role of teachers in shaping the minds of children is a great responsibility, and inspiring their students to work harder and realize their personal and social aspirations cannot be underestimated. To achieve them, teachers try to curb bullying, aggressive or fighting behaviours of students. They deal with problems in the home life of students, adolescence or personal growth, abuse and neglect. The conclusion is that teacher motivation, which includes teacher tenure, teacher professional mobility (promotion), and regular teachers' pay, affect students' outcomes. Based on the results, the following were recommended:

1. The Ministry of Education must regularly review teachers' records and give teachers promotions based on their qualifications, commitment and workload.
2. School boards should work hand in hand with the Ministry of Education to ensure prompt and regular payment of teachers' interim salaries and teachers' salary increases and competitive salaries.

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AI AND THE FUTURE OF EDUCATION IN DEVELOPING COUNTRIES: ISSUES AND PROSPECTS

Akeem Amodu¹

amodu.akeem@lcu.edu.ng

<https://orcid.org/0000-0001-8677-9948>

Bamidele Stephen Omoyajowo²

omoyajowo.bamidele@lcu.edu.ng

<https://orcid.org/0009-0009-7824-2580>

Phone: 09039287758, 07034563375

Femi Adeoye Alabi³

falabious@yahoo.com

+2348035085305

¹Department of Politics and International Relations,
Lead City University, Ibadan

²Department of Science Education,
Lead City University, Ibadan

³Department of Science Education
Lead City University

Abstract

The rapid advancement of Artificial Intelligence (AI) is reshaping the global educational landscape, offering transformative opportunities as well as complex challenges, particularly for developing countries. This paper attempts a critical examination of the role of AI in shaping the future of education in developing contexts, with Nigeria and Ghana serving as focal case studies. By extension, the paper is an explorative attempt to see how AI-driven technologies, ranging from adaptive learning platforms and automated assessment tools to intelligent tutoring systems and natural language processing applications, are beginning to influence teaching, learning, and administration within both formal and informal education sectors. While AI holds immense promise in addressing systemic deficiencies such as teacher shortages, curriculum gaps, and student disengagement, the paper draws attention to deep-seated structural and ethical concerns. Imperative AI concerns for developing countries include digital infrastructure deficits, algorithmic bias, data privacy, lack of regulatory frameworks, and widening educational inequalities due to uneven access to AI tools. Through comparative analysis, the study attempts to draw on national policies, pilot projects, and academic-industry collaborations in Nigeria and Ghana to assess levels of AI integration, local innovation, and stakeholder preparedness. Through philosophical reflections, the paper argued for the position that AI should be viewed as a catalyst rather than as a disruptor in educational development. This position will require advocating for the adoption of inclusive policies, ethical governance, capacity-building, and localized content development. The paper concluded by outlining actionable strategies for governments, educators, and technologists to harness AI in a manner that is equitable, context-sensitive, and sustainable. In doing so, the study contributes to the growing discourse on the future of education in the Global South while also offering a framework for leveraging AI as a tool for educational transformation in Africa

Keywords: Artificial Intelligence, Education, Developing Countries, Technology Integration, Educational Transformation

1. Introduction

The educational system has changed dramatically in the 21st century due to significant advances in AI, digital technologies, and global economic pressures. As AI and education merge, stakeholders across sectors must rethink learning paradigms, delivery methods, pedagogical techniques, and even the role of the educator in the knowledge society. As machine learning, natural language processing, and generative models evolve, their impact on education systems globally grows. AI is improving teaching and learning and forcing a rethinking of educational goals, labour preparedness, and knowledge development (Dwivedi et al., 2020).

In recent years, generative AI technologies like ChatGPT have caused both excitement and fear in academia, industry, and policymaking. These tools challenge authorship, assessment, and knowledge validation while presenting huge possibilities for personalised learning, curriculum design, and administrative efficiency (Dwivedi et al., 2023; Krishnamurthy, 2020). As AI becomes more integrated into education, ethics, diversity, and human-AI collaboration become central, requiring new frameworks for understanding and governance. While the global economy shifts towards Industry 4.0, fundamental skills and competences are changing. Automation, data analytics, robotics, and intelligent systems require a digitally literate, adaptable workforce. This trend has major ramifications for education systems, especially reskilling and upskilling (Li, 2022; Tjoa & Guan, 2020).

Globalisation continues to shape education policies, priorities, and pedagogies. Education must cross boundaries and educate students for global contexts in a world of interrelated economies, cultures, and knowledge systems. This requires reinventing education as a globally relevant and socially just industry (Rizvi et al., 2022). AI can help reduce educational inequality by delivering scalable and adaptive solutions. This may be because AI may help fix education's long-standing inequalities in access, quality, and equity, not only optimise. Realising this promise requires intentional measures adapted to developing nations' socio-economic and technological conditions.

AI can boost academic output, personalise learning, and improve teaching efficiency in Africa. According to Segbenya et al. (2024), AI use in higher education has already begun to change academic activities, which may boost research, student support, and institutional decision-making. Their mixed-method study on Ghanaian higher education institutions shows that AI-related factors including technology preparedness and institutional commitment boost academic production. This observation is especially pertinent for Nigeria, where expanding student populations and limited academic staff capability require novel task management and high learning results.

AI in university scientific curricula is also a promising way to improve STEM education in Nigeria. Aiyedun (2024) stresses the significance of integrating AI into science education to teach Fourth Industrial Revolution capabilities. Despite this requirement, faculty competence, outmoded curricula, and poor technology infrastructure hinder integration. These gaps demonstrate the need for targeted curriculum change, teacher training, and digital infrastructure development in African universities. AI can democratise rural schooling beyond measure. When used properly, mobile-based AI can offer content to remote learners, personalise training, and fill teacher shortages. AI-enhanced mobile learning systems can improve rural Nigerian inclusive education, according to Olugbade (2024). This strategy promotes equity, sustainable development, and education for underprivileged populations. However, unstable electrical supply, low internet penetration, and digital literacy gaps must be overcome for successful adoption.

Muhammad et al. (2023) explore AI, labour skills, and economic mobility in Ghana and Nigeria from a socioeconomic perspective. They found that AI is changing the abilities needed in modern

jobs, making educational systems to adapt quickly. This shift emphasises the need for curriculum that emphasise creativity, adaptability, and critical thinking as well as technical abilities. However, without legislative and educational reform, AI could displace low-skilled workers and limit upskilling prospects, worsening disparities. AI adoption in Africa is hindered by a lack of finance, policy frameworks, and localised data for algorithm development. These challenges and new prospects for leapfrogging established growth pathways are described by Arakpogun et al. (2021). Their argument emphasises the need for government, business, and academic collaboration to safely and inclusively use AI. This includes technological deployment, governance, ethics, and local relevance of AI tools in education.

This project is urgent because it must rigorously evaluate how AI can speed educational transformation in Nigeria and Ghana while limiting its hazards. Strong national strategies for AI integration in education are needed, from policy formation and teacher capacity investment to public-private partnerships and inclusive technical innovation. Context-specific research and Global South students' and educators lived realities must inform such solutions. Thus, this paper sought to add to the debate on fair and context-sensitive AI integration in education to create sustainable, inclusive, and future-ready learning environments, particularly in developing nations like Nigeria and Ghana.

2.0 CONCEPTUAL CLARIFICATIONS

2.1 Artificial Intelligence (AI)

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think, learn, and make decisions autonomously. In the education sector, AI is becoming a transformative force, capable of redefining how knowledge is delivered, assessed, and managed. The rise of generative AI models such as ChatGPT has sparked global conversations about its implications for learning, research, and policy (Dwivedi et al., 2023). These technologies can generate content, evaluate student responses, provide instant feedback, and even assist in curriculum design. As Li (2022) points out, AI is central to the future of work and learning in the Industry 4.0 era, necessitating reskilling and upskilling at unprecedented scales. In developing regions, such as Africa, AI is simultaneously viewed as a tool for innovation and a source of socioeconomic tension.

2.2 Adaptive Learning

Adaptive learning systems use AI algorithms to tailor educational content and experiences to individual learner profiles. These systems analyse student data (including responses, performance trends, and engagement patterns) to dynamically adjust instructional content in real-time. The aim is to ensure that each learner receives personalized support according to their strengths and weaknesses. In higher education, adaptive learning has been linked to increased academic productivity.

2.3 Intelligent Tutoring

Intelligent Tutoring Systems (ITS) are another application of AI in education that mimics the role of a human tutor by offering customized feedback, scaffolding, and real-time assessment. Unlike traditional learning platforms, ITS can engage learners in dialogic interactions, track emotional states, and recommend learning paths. Tjoa and Guan (2020) highlight the importance of explainability in such systems, especially when they are deployed in sensitive or high-stakes educational environments. In the context of developing countries, ITS presents a powerful solution to teacher shortages and overcrowded classrooms.

3.0 THEORETICAL LENS

The integration of Artificial Intelligence (AI) into global education systems is not only a technological advancement but also a profound theoretical challenge. Understanding how and why AI reshapes education requires an analysis of the underlying philosophical frameworks guiding such transformations. Two contrasting paradigms that dominate the discussion on the role of AI in education are technological determinism and human-centred approaches.

3.1 Technological Determinism

Technological Determinism holds that technology drives social change, frequently without human intervention. In this view, new technologies like generative AI set the course for institutional transformation, especially in education. The revival of technological determinism in AI discourse reflects increased views that intelligent computers would revolutionise education, labour, and society, according to Héder (2021). AI tools like ChatGPT, adaptive learning systems, and intelligent tutoring platforms are considered as forces shaping learning. This determinist approach is evident in how some institutions and policymakers use AI in education to improve efficiency, personalisation, and scalability. Budhwar et al. (2023) show how generative AI in HRM, including academic HRM, has automated recruitment, performance evaluation, and staff development. Similar tools are replacing or redefining educator duties like content generation and feedback delivery. However, this perspective risks overemphasising technology and discounting human values, agency, and social processes. It generally downplays ethical, emotional, and professional teaching and learning. AI's integration into learning may depersonalise, and be led by algorithms rather than pedagogy (Coombs et al., 2021).

3.2 Human-Centred Approaches

Instead, Human-Centred Approaches create and operate AI systems with human agency, ethics, and social context in mind. This viewpoint holds that AI can aid learning but should not replace human skills like emotional intelligence, creativity, empathy, and critical thinking. Human-centred frameworks put human values and professional judgement into AI design and implementation rather than letting technology determine education. Applying the principle of professions to academic library labour, Cox (2022) shows that AI should respect and promote professional identities and capacities. In education, educators must make pedagogical decisions while AI supports them. According to Coombs et al. (2021), moral thinking, profound contextual awareness, and interpersonal communication cannot be automated without severe social cost. Oritsegbemi (2023) also stresses the need of human communication, especially emotional aspects that AI cannot imitate. Overusing AI in education could harm student engagement, empathy, and trust, especially in culturally sensitive and emotionally charged learning situations.

4.0 METHODOLOGY

This study adopted a systematic research design to investigate the rise of Artificial Intelligence (AI) and its role in global education transformation, with a specific comparative focus on the Nigerian and Ghanaian educational systems. A systematic research approach, as emphasized by Zheng (2015), was particularly useful for mapping the trajectory of AI adoption in education by analysing multiple sources of empirical and conceptual data across different socio-educational environments. The systematic design was chosen to ensure a rigorous, transparent, and replicable process of data collection, analysis, and synthesis, allowing for the generation of robust insights across national contexts. The study also integrates principles from Zaphiris et al. (2006), emphasizing the need for structured and user-centred inquiry in the development and evaluation of technology-driven educational innovations.

A systematic review of peer-reviewed articles, institutional reports, and grey literature was conducted, focusing on AI applications in global education, particularly within sub-Saharan Africa. Databases searched included Google Scholar, Scopus, JSTOR, and Science Direct. A total of 76 studies were initially retrieved, with 35 meeting the final inclusion criteria after screening for quality and relevance. His phase involved collecting secondary data from education ministries, AI-focused educational pilot programs, and national technology policies of Nigeria and Ghana. The key dimensions for comparison included: (a) level of AI adoption and infrastructure; (b) policy frameworks and government support; (c) teacher and student digital literacy; (d) Integration of AI in teaching, curriculum, and assessment; and (e) localized barriers and enablers of AI use.

5.0 AI IN EDUCATION: OPPORTUNITIES

The integration of Artificial Intelligence (AI) into education presents significant opportunities that can redefine learning and teaching across all levels of education. As educational systems around the world seek to enhance quality, access, personalization, and efficiency, AI technologies have emerged as powerful tools capable of transforming how education is delivered and experienced.

- 1. Personalized Learning Pathways:** One of the most prominent benefits of AI in education is its capacity to personalize learning. AI systems can analyse learner data in real time and tailor content, pace, and instructional strategies to meet the individual needs of students (Lydia et al., 2023).
- 2. Enhanced Teaching and Learning Efficiency:** AI tools are automating routine educational tasks such as grading, lesson planning, and scheduling, freeing up teachers to focus more on student engagement and creative instruction. According to Eden et al. (2024), this shift not only improves efficiency but also reduces teacher burnout and administrative overload.
- 3. Accessible and Inclusive Learning Environments:** AI technologies improve accessibility, thus aiding disabled learners. Text-to-speech, speech-to-text, real-time translation, and AI-driven sign language avatars make learning inclusive. As Boxleitner (2023) notes, AI's multimodal learning formats allow students with various learning requirements and preferences to receive superior instruction.
- 4. Improved Engagement through Generative AI Tools:** Generational AI models like ChatGPT enable interactive learning environments where students can ask questions, receive explanations, or imitate discussions, improving student engagement. Michel-Villarreal et al. (2023) remark that such tools can provide 24/7 academic help, especially in higher education where students need flexible assistance outside of class.
- 5. Support for Early Childhood Education:** Even in early childhood schooling, AI is rising. AI-powered narrative systems and learning bots are teaching language, numeracy, and social skills. Su et al. (2023) claim that such tools inspire young learners' curiosity and creativity while giving educators real-time cognitive development data. These apps can assist teachers tailor information to developmental milestones.
- 6. Fostering Research and Innovation:** AI is changing education research and pedagogy. Platforms that evaluate enormous datasets, generate literature reviews, and improve academic writing accelerate and improve research. Alasadi and Baiz (2023) note that AI is helping academic research by speeding knowledge discovery and boosting interdisciplinary collaboration.
- 7. Global Reach and Scalability:** AI's scalability brings educational breakthroughs to remote, underserved, or low-resource areas. Cloud-based AI platforms and mobile apps provide high-quality instructional content without infrastructure. Eden et al. (2024) and Boxleitner (2023) argue that this competence is essential for egalitarian education in line with global goals like the UN's Sustainable Development Goal 4.

6.0 CHALLENGES AND STRUCTURAL BARRIERS OF AI IN EDUCATION

Despite the rapid growth and promise of artificial intelligence (AI) in education, several critical challenges and structural barriers continue to hinder its effective and equitable integration. These barriers, particularly visible in developing and transitional education systems, affect the accessibility, ethical deployment, and sustainability of AI-driven innovations, which include:

1. **Digital Infrastructure Gaps:** In many parts of Africa and other developing contexts, poor internet connectivity, limited access to digital devices, and frequent power outages severely limit the effective use of AI-powered educational tools (Ayanwale et al., 2022). Cheng and Wang (2023) also observed that without robust digital environments, even well-designed AI tools fail to translate into meaningful classroom interventions.
2. **Algorithmic Bias and Ethical Dilemmas:** AI systems, especially those with enormous datasets, might reinforce social biases. Such approaches may promote unfair treatment or stereotyping of particular students in education. Okolo et al. (2022) note that Western-centric AI models employed in Africa produce culturally insensitive information, limiting relevance and promoting marginalisation. Biases in prediction algorithms may disadvantage low-resource and minority students.
3. **Privacy and Data Protection Concerns:** To work, AI systems need massive amounts of student data, posing privacy and data exploitation concerns. In weak or poorly enforced data governance rules, sensitive educational data may be breached or misused. Onyejebu (2023) noted that many Nigerian colleges lack data handling and privacy guidelines, putting students' personal data at risk in AI-integrated learning systems.
4. **Regulatory Vacuum and Policy Incoherence:** AI has the ability to alter educational leadership and administration, but confusing governance structures and a lack of national AI education plans have fragmented its deployment (Avurakoghene and Oredein, 2023). This vacuum causes conflicting standards, inadequate supervision, and uncoordinated AI adoption across West Africa.
5. **Inequality in AI Access and Literacy:** AI literacy among educators and students is part of the digital divide, not just infrastructure. AI-untrained teachers are found in developed and emerging nations (Ayanwale et al., 2022). Disadvantaged students are less likely to engage in AI-enhanced learning environments, widening educational gaps.
6. **Impact on Academic Integrity:** Generative AI threatens academic integrity. ChatGPT is used for plagiarism or avoiding academic effort, making it hard for schools to assess learning outcomes. Wiredu et al. (2024) found that Ghanaian educators are concerned about AI-enabled academic dishonesty, especially in schools without detection tools.

7.0 OVERVIEW OF AI TECHNOLOGIES IN EDUCATION: CASE INSIGHTS FROM NIGERIA AND GHANA

This section provides an overview of the AI technologies applied in education and presents case insights from Nigeria and Ghana, highlighting platforms, pilot innovations, and academic-industry collaborations. In Nigeria, AI is being gradually integrated into both formal and informal education systems, often through hybrid digital strategies and partnerships. In Ghana, AI's role in education is expanding through strategic integration into tertiary institutions and policy-driven digital transformation efforts.

7.2.1 AI-Based Tools and Platforms: Nigeria vs Ghana

Several Nigerian universities are piloting AI-based curriculum delivery systems. Aiyedun (2024) notes that Nigerian institutions have begun incorporating AI modules into science education curricula, using platforms such as Google Classroom integrated with adaptive learning engines and voice assistants. Additionally, Olugbade (2024) highlights the use of mobile-based AI learning platforms in rural Nigeria. These platforms help democratize learning by enabling access

to educational content through voice-enabled interfaces that overcome literacy and language barriers. According to Muhammad et al. (2023), Ghanaian universities are utilizing AI platforms such as Moodle integrated with machine learning algorithms to provide individualized feedback, academic tracking, and resource recommendations. Additionally, pilot platforms such as "EduTech Ghana AI Hub" support skill-based learning and teacher development using intelligent dashboards.

7.2.2 Pilot Projects and Local Innovations: Nigeria vs Ghana

Pilot projects like AI-powered STEM labs and coding programs sponsored by non-profits (e.g., Andela and AI Saturdays Lagos) focus on youth capacity development. These initiatives train learners in AI programming and problem-solving through local language support and gamified environments. Moreover, mobile AI tutors are being tested in under-resourced schools to assist students in self-paced learning, particularly in mathematics and science subjects (Olugbade, 2024). On the other hand, Ghana's Ministry of Education, in collaboration with UNICEF, has piloted AI-powered adaptive learning tools for primary school students to improve literacy outcomes. Segbenya et al. (2024) report that these tools increased academic productivity by enabling self-regulation among learners and facilitating data-driven decisions by instructors. Other innovations include AI-supported career guidance platforms that recommend vocational and academic pathways based on aptitude test results and student preferences.

7.2.3 Academic-Industry Collaborations: Nigeria vs Ghana

Collaborations between institutions like Covenant University and industry players (such as Data Science Nigeria and Microsoft AI for Good) are supporting curriculum development, faculty capacity-building, and student bootcamps focused on AI literacy (Arakpogun et al., 2021). Academic collaborations with private sector firms (such as Ghana Tech Lab and Google AI) have resulted in research labs and curriculum development workshops that aim to increase institutional AI literacy. These collaborations have not only enhanced AI adoption but also contributed to the creation of local data models tailored to Ghanaian educational realities (Arakpogun et al., 2021).

8.0 COMPARATIVE ANALYSIS OF THE USE OF AI IN NIGERIAN AND GHANAIAN EDUCATIONAL SYSTEMS

Africa is using AI in education at varied rates and intensities. An AI education ecosystem comparison of Nigeria and Ghana—two major West African nations—reveals key parallels and contrasts. Policy readiness, innovative ecosystems, capacity-building, and stakeholder engagement show these differences.

8.1 Policy Readiness

Ghana has developed more organised AI policy alignment for education progress than Nigeria. Ghana's AI plan and digital education activities are gradually creating a policy framework that promotes intelligent technology in higher education (Segbenya et al., 2024). Nigeria's instructional AI strategies are currently in development. Nigeria issued a National Artificial Intelligence Policy draft in 2023, however implementation is delayed and lacks an educational framework (Muhammad et al., 2023). Policy fragmentation and institutional misalignment restrict school AI implementation in Nigeria (Aiyedun, 2024). Ghana's unified regulatory strategy boosts university productivity and AI experimentation (Segbenya et al., 2024).

8.2 Innovation Ecosystems

Nigeria has a broader, loosely structured AI innovation ecosystem with many firms and educational technology developers. These innovations are usually limited to cities and run in silos without significant public-private links (Olugbade, 2024). While Ghana's innovation ecosystem is smaller, academia, the commercial sector, and government institutions collaborate to create localised AI solutions for education (Muhammad et al., 2023). This synergy in Ghana provides adaptive learning models and data-driven decision-making tools to meet national educational goals (Segbenya et al., 2024). Nigeria has more AI developers and research organisations, but legislative and infrastructural barriers hinder scaling and integration (Arakpogun et al., 2021).

8.3 Capacity-building

Both countries face capacity-building issues in distinct ways. Donor assistance and university initiatives are adding digital pedagogy and AI literacy to Ghanaian teacher preparation programmes (Segbenya et al., 2024). In contrast, Nigeria has prioritised university-level AI research and curricular integration in science and engineering (Aiyedun, 2024). The efforts are rare and generally lack funding constancy. Importantly, both nations struggle to train educators in AI-based learning settings (Kolade et al., 2022). Digital training and AI curricula are urgently needed.

8.4 Stakeholder Engagement

Ghana has better cross-sector stakeholder engagement. Ghanaian universities, NGOs, and policymakers are discussing AI's ethical and practical implications for education (Segbenya et al., 2024). AI-driven educational reforms gain openness, innovation, and trust from this involvement. Fragmented stakeholder participation is common in Nigeria. Independent educational institutions and private IT corporations rarely consult educators or students (Olugbade, 2024). Interventions like relationships with multinational tech giants are not yet institutionalised or scaled.

8.5 AI and Learning Results

Both countries have tested adaptive learning and predictive analytics to improve student results. Predictive algorithms and mobile-optimized learning systems are being tested to identify at-risk kids and personalise learning (Maulana et al., 2023; Sari, 2024). Technical and infrastructural issues limit its practical influence. These methods may benefit Ghana's higher education industry more directly due to increased policy and institutional alignment (Segbenya et al., 2024). Nigeria is more engaged in AI development but has significant implementation gaps, especially in underserved regions (Olugbade, 2024).

8.6 Moral and Social Issues

Both countries are slowly accepting AI's ethical implications for data privacy, justice, and academic integrity. However, ethical readiness differs. Some Ghanaian colleges have ethical AI conversations, while Nigerian universities are still integrating AI policy and lack ethical AI frameworks (Al, 2023; Muhammad et al., 2023).

9.0 PHILOSOPHICAL REFLECTIONS

This study argues that AI could be seen as a catalyst for educational growth, especially in developing countries like Nigeria and Ghana, through philosophical reflections and ethical discourse. Holmes et al. (2021) stress that ethical AI in education must reflect human values, educational goals, and social justice. Philosophically, AI encourages educators and institutions to rethink teaching, learning, and evaluation in more inclusive, adaptable, and student-centred ways. Yang et al. (2021) propose a “human-centred” approach to AI in education that makes the “invisible visible” through data-informed insights and intelligent technologies, complementing educators.

To use AI as a catalyst, you must go from fear-based resistance to purpose-driven creativity. De Sio and Mecacci (2021) propose that transparency, accountability, and contextual justice in AI design and use can close responsibility gaps in AI governance. AI that is ethical supports educational principles like equity, autonomy, and well-being. AI can help overcome teacher shortages, learning material constraints, and evaluation bottlenecks in West African education (Olugbade, 2024). Thus, ethically deployed AI can improve learning for marginalised populations rather than undermining educational systems. Thus, stakeholders should use AI to enhance human dignity, critical thinking, and lifelong learning rather than presuming a one-size-fits-all model. This approach will make AI a strategic partner in attaining the Sustainable Development Goals for education, not a threat.

10. CONCLUSION

The integration of AI in Nigeria and Ghana’s Education is challenging and promising. This review examined the existing situation, prospects, problems, and future orientations of AI implementation in these two West African nations' educational systems using empirical studies and conceptual reflections. With various pilot projects, AI-driven learning platforms, and university-based innovations, the comparative assessment shows that Nigeria and Ghana are gradually adopting AI technology in education. Personalised learning systems, performance prediction algorithms, and virtual tutoring platforms can improve educational access and outcomes. Critical structural impediments are also identified in the investigation. These include digital infrastructure gaps, unequal AI tool and skill access, ethical governance framework gaps, privacy concerns, algorithmic bias, and educational unpreparedness. Limited policy preparation and fragmented stakeholder involvement exacerbate these issues. Philosophy and ethics remain focused on who benefits from AI, how it should be managed, and how to apply it justly and fairly. Nigeria and Ghana must deal with global-local imbalances in AI design and implementation, which can empower or marginalise depending on context.

AI can improve educational equity, innovation, and inclusion despite its limitations. AI is changing curriculum, pedagogy, and student involvement in Ghana and Nigeria. AI can close learning gaps, democratise quality training, and give real-time feedback and support for teachers and students when used properly. However, this change is not automatic. It requires conscious policymaking, ethical design, stakeholder participation, and fair AI tool and digital infrastructure access. AI's potential could exacerbate inequality without these cornerstones. Hence, as AI becomes increasingly embedded in educational systems globally and across Africa, including Nigeria and Ghana, there is an urgent need to shape its integration through informed, ethical, and inclusive policy and practice recommendations. Drawing upon a diverse set of studies, the following key policy and practice areas are recommended:

1. National education ministries should prioritize participatory policy development that supports multi-lingual, culturally relevant, and locally adaptable AI tools.

2. Ministries of Education and technology regulators should establish national ethical AI councils with oversight on fairness, transparency, and accountability, drawing from both global standards and local values.
3. Governments and educational institutions should fund research and innovation grants for local developers to build AI-driven educational content in native languages.
4. Governments and educational institutions should integrate AI literacy and digital pedagogy into teacher education programs.
5. Governments should bridge the digital divide by expanding rural internet access and mobile-based AI learning platforms.
6. Governments should bridge the digital divide by establishing community-based digital learning hubs with solar-powered technology and offline AI tools.
7. Develop AI equity protocols to audit and monitor algorithms for bias and provide targeted digital literacy programs for underrepresented groups, including girls, rural students, and learners with disabilities.
8. Governments and educational institutions should establish national AI-in-Education partnerships that link universities, EdTech companies, government agencies, and teacher unions to co-create solutions and conduct impact assessments.
9. Governments and educational institutions should enact student data protection laws, define academic AI usage policies, and equip educators with tools to uphold integrity in AI-enhanced assessments.

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