

EDUCATION DIALOGUE ASSOCIATION

JOURNAL OF MULTIDISCIPLINARY STUDIES (EDUDIA-JOMS)

EDUDIA-JOMS VOL 2 NUMBER 1, 2026

Print ISSN: 3141-6500

Online ISSN: 3141-6594

Journal URL: https://edudia.orgpublications/

UNIVERSITY OF EDUCATION, WINNEBA, GHANA

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EDUDIA-JOMS VOL. 2, NUMBER 1, 2026

PRINT ISSN: 3141-6500

ONLINE ISSN: 3141-6594

University of Education, Winneba, Ghana

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THE NATIVISATION OF SIERRA LEONEAN ENGLISH AND ITS PEDAGOGICAL IMPLICATIONS

Momodu Turay, Ph.D
Department of Language Studies
Fourah Bay College, University of Sierra Leone
Email: momoduturay1@yahoo.co.uk
momodu.turay@usl.edu.sl
Tel: +232-785-13296

Abstract
For nearly six decades, English language instruction in Sierra Leone has been predominantly guided by British Standard English, with educators focusing primarily on error correction rather than recognizing local linguistic variations. Owing to the country's independence in 1961 and the undeniable influence of environmental factors on language evolution, there remains little justification for teachers to disregard the legitimacy of Sierra Leonean English. Given the unpredictability of language development, it is crucial for educators to examine both spoken and written English within Sierra Leone to define and guide an emerging standard. This study aims to identify the lexical and grammatical features of Sierra Leonean English, and to account for their usage. The lexical features explored include collocation, modification, idiom, innovation, and aboriginal - related influence. These features can be traced to the subjects' local languages, the influence of native English, analogy, and some learning induced factors. Grammatical features are examined across categories such as noun, pronoun, verb, adjective, determiner, preposition, word class, and syntax-related elements. These features can also be traced to not only to the subjects' first languages but also to learning - induced factors which include over generalization of native English rules, ignorance of these rules, and their incomplete application. The analysis employs Selinker's Interlanguage Fossilization Theory (1972) and Kachru's Nativisation Theory (1992), using texts authored by Sierra Leonean writers as primary data sources. The findings indicate the implications of the above subjects' features for English Language teaching in Sierra Leone. The study concludes by advocating the need for educated Sierra Leoneans and language practitioners to adopt a more receptive attitude towards linguistic nativisation.

Keywords: Sierra Leonean English, Nativisation, Interlanguage, Fossilisation

INTRODUCTION

Just four years after Sierra Leone attained its independence, Jones (1965) stated that just as differences are bound to exist among native English speakers when they have learnt their different environments, Sierra Leoneans who learn English in their own environments will have to speak and write differently from other English speakers. These differences can be seen in their vocabulary and even in their syntax. He therefore advocated the need to "study specimens of both spoken and written English in Sierra Leone in order to decide what [our] standard is", (1965, 35). However, sixty – one years later, this call has not been fully heeded in Sierra Leone as the English Language instruction has been predominantly guided by British Standard English mainly because Britain controlled the educational system after Freetown – Sierra Leone's capital city – was declared as a crown colony in 1808.

Jones' observation is made clear by the research studies on the use of English in the country at various academic levels. For example, Mettle (1984) examined the errors in the written English

of pupils from five primary schools in the Western Area. Challay and Jones (2019) investigated the capitalization errors among junior secondary pupils in Bo. In addition, Dauda (2022) examined how Krio has negatively impacted on the written English of senior secondary school pupils of Sierra Leone. Earlier, Sesay's (1983) doctoral thesis investigated the lexical and grammatical errors in the noun phrase in the written English of university students in Sierra Leone. Clearly, the above researchers used elusive benchmarks – British and American standards – to examine their subjects' interlanguage. The above researchers stated that the subjects' language usage was fraught with problems. The problem has reached its crisis over two decades as is shown by the Permanent Secretary of the Ministry of Technical and Higher Education (MTHE) describing the performance of West African Senior School Examination (WASSCE) candidates in June 2025: "despite the progress in other subjects, 63% failure rate in English Language creates an immediate bottleneck, preventing thousands of qualified students from transitioning into Higher Education" (Kargbo, Ministry of Technical and Higher Education (MTHE) 24th March, 2026 p1).

The main aim of this study is to identify the lexical and grammatical features of Sierra Leonean English. The specific objectives are to account for these features and to show the implications of this phenomenon for English Language teaching in Sierra Leone. The features will constitute the peculiarities -not errors- of educated Sierra Leoneans whose exposure to formal instruction has made them confident to express themselves in books that have been published either within or beyond the country.

Kachru's concept of nativisation is an off-shoot of his three concentric circles which he views as representatives of 'the types of spread, the patterns of acquisition, the functional acquisition of English in diverse cultural contexts' (Kachru,1992:351). These circles include the Inner Circle which represents the traditional, cultural and linguistic bases of English, the Outer Circle which involves countries that use insitutoinalised but non-L1 varieties of English, and the Expanding Circle which deals with countries where Englis operates as a foreign language. Nativisation which involves the Outer Circle is directly related to the concept of 'New Englishes'.

Kachru argues that nativisation makes English experience readjustments at various linguistic circumstances leading to the growth of many English varieties. Thus, the development of distinctive local 'deviations' in the use of English is as a result of the pressures on the language to acculturate to its new socio-cultural context (Kachru, 1992:59). In this connection, he describes what he refers to as 'non native institutionalized varieties' of the English Language.

He does not, however, lose sight of the distinction between deviations from errors. It is on this basis that the present research could be related to both Selinker's and Kachru's theories.

The data collected for this research were analyzed in terms of Selinker's Interlanguage Fossilisation Theory (1972) and Kachru's Nativisation Theory (1992). Both theories are complementary in the analysis of the data. A learner's interlanguage is concerned with his/her knowledge of the target language at a given time. Selinker contends that there are several stages which the learner passes through before he/she is said to have attained proficiency in the target language. He further states that there are five processes involved for the existence of an interlanguage in second language learning : the generation of a sentence in the target language in the same way in which the producer would if he were to express the same meaning in his native language (language transfer); the existence of linguistic items in the learner's language which originate from training procedures (transfer of training); the methods the learner adopts in his attempt to comprehend target language grammar (strategies of second language learning); the

learner's approach when he communicates with native speakers of the language (strategies of second language communication); and the use of a particular language rule more than how the rule is used by the native speakers of the target language (over-generalization of language rules). Selinker concludes that the persistent recurrence of any of the above processes may lead to fossilization in what would have otherwise been transitory language forms.

The research method adopted in this study is mainly qualitative. The specific design used is descriptive as it identifies the lexical and grammatical peculiarities in sixteen Sierra Leonean novels, one drama text, and five anthologies comparing them with Standard British English. The lexical and grammatical peculiarities have been selected because words are important as the use of a specific word instead of another can account for different meanings in a language. Moreover, learning the grammar of a language will enable the user to know why utterances are produced, why they mean what they mean and do what they do.

The lexical peculiarities that were recorded are collocation, modification, idiom, innovation, and aborigine. The grammatical peculiarities are noun, pronoun, verb, determiner, adjective, preposition, word class, and syntax. The peculiarities are presented in two tables, namely Table1 and Table2. Table1 contains the lexical peculiarities and Table2 contains the grammatical peculiarities. In each of the tables, the peculiarity is highlighted demonstrating its classification, the British equivalence, the title of the text, the author, page number, and the date of publication of the text. The above sources of information largely follow those highlighted by Kamtueng and Meutem (2014). The novels from which the peculiarities are drawn are : *Clouds of a Ghoullish War* -CGW (Gboyor,2018),*The New Disease*- TND (James,2016), *Leave it to Naasu*- LN (Fofana,2020), *Gomna's Children-GC* (Kroma, 2010), *The Diamonds-TD* (Conteh,1997), *In Search of Sons*-ISS (Conteh,2007, *The Road to Freedom*-TRF(Hunter,1982), *Joy Came in the Morning*-JCM (Hunter,2013), *Mouths of the Junction*-MJ (Sesay,2017), *Who Is to Blame ?-WItB* (Sesay,2016),*Landscape of Memories* LM Sesay,2015), *So the Path Does not Die*-SPDD (Hollist,2012), *The Road to Kaibara*-TRK (Hallowell,2015),and *Pope Francis, Politics, and the Mabanta Boy*-PFPMB (Tarawallie,2019). The drama text that is captured is *The Visa*- TV (Kamanda,2017). The memoirs that are involved in this study are *The Freetown Bond*-TFB (Jones,2012) and *How to become Successful with your Talents*-HST (Sesay,2020). The anthologies that are involved in this study are: *Contemporary Fireside Stories*_ CFS (Thulla, Yamba and Taqi,2017) which inter alia contains My Brother's Confession (Thompson); *The Price and Other Stories*-TPS (Kamanda,2012) which contains The Price (Sesay), Family Affair (Sheriff), and Removing the Veil (Taylor); *Gbombosoro* _ (Hallowell,2012) , *Winter in Harmattan and Other Short Stories*-(Kenny,2015), *Fishing in Rivers of Sierra Leone* -FRSL (Hinzen et al (1987).

The secondary data which covers both the lexical and grammatical peculiarities involve the following: *Oxford Advanced Learner's Dictionary* (Hornby,2020), *Krio-English Dictionary* (Fyle and Jones 1980), *Practical English Usage* (Swan, 2016), *Cambridge Grammar of English*, (Carter and McCarthy, 2006), *The Cambridge Grammar of the English Language* (Pullum and Huddleston, 2002), *The Handbook of English Linguistics* (Aarts and McMahon, 2006), *An Introduction to Language, 6th Edition, Cengage Learning*, (Fromkin, & Rodman 1997), *All What I Was Taught and Other Mistakes: A Handbook of Common Errors in English,* (Hocking, 1974/1984), *Kenyan English De Gruyter Mouton* (Buregeya, 2021), *A Survey of Sierra Leonean English* (Warima: Sierra Leonean Writers Series) (Turay, 2025), and *Senior School Certificate Examination(SSCE) English Language Past Questions and Answers* (Kolawole, 2005) and Hybrid Eyes Reflections of an African in Europe (Sankoh, 2016).

This data also includes Chief Examiners' reports on the performance of West African Senior Secondary School candidates on English Language ranging from 2000 to 2004

Data Presentation

The data is presented in tables 1 and 2 which respectively deal with the subjects' lexical and grammatical peculiarities.

Table 1: The lexical peculiarities of Sierra Leonean Authors

No	Peculiarity	British equivalent	Classification	Text	Author	Page	Date
1	Aunty Matty and Pa Heddle did not treat Fina differently *than* their own children.	Aunty Matty and Pa Heddle did not treat Fina differently *from* their own children.	Native English Collocation	SPDD	Hollist	19	2012
2	We don't have time to *hang heads.*	*We don't have time to confer.*	Krio – induced collocation	GC	Kroma	20	2010
3	…then he felt his *head turning* and his eye watering.	…then he felt *dissy* and his eye watering.	Krio – induced collocation	GC	Kroma	37	2010
4	That was my first encounter with *woman damage.*	That was my first encounter with *the payment of price for illegally having an affair with a married woman.*	Cultural – induced collocation	ISS	Conteh	115	2007
5	He removed the *chewing stick* to wish us well.	He removed the *tooth brush* to wish us well.	Cultural – induced collocation	JCM	Hunter	80	2013
6	Another school of thought was that a *witch plane* had crashed and those who were dying were passengers onboard the plane.	Another school of thought was that a *plane with spiritual powers* had crashed and those who were dying were passengers onboard the plane.	Cultural – induced collocation	Winter in Harmattan and other Short Stories	Kenny	12	2015
7	Practices he once hardly noticed now loomed *big* in his eyes.	Practices he once hardly noticed now loomed *scary* in his eyes.	Word extension	GC	Kroma	73	2010

8	Sento cried out as she *sank* in the deep water.	Sento cried out as she *drowned* in the deep water.	Word extension	WItB	Sesay	176	2016
9	In fact, the pa is thinking of *moving* him from Social Mobilization to the Rep's office anytime.	In fact, the pa is thinking of *relocating* him from Social Mobilization to the Rep's office any time.	Word extension	CGW	Gboyor	61-62	2018
10	Bonkehan village was *popular* for black magic.	Bonkehan village was *notorious* for black magic.	Word change	TPS	Taylor	118	2012
11	He was educated and critically minded enough to have seen the *writings* on the wall	He was educated and critically minded enough to have seen the *writing* on the wall	Native English Idiom	LM	Sesay	141	2015
12	He will not come all the way here only for us to *smile in each other's face.*	He will not come all the way here only for us *to wipe the smile in each other's face.*	Native English Idiom	TND	James	142	2016
13	… and I saw my investment literally disappearing *before my eyes.*	… and I saw my investment literally disappearing *with my eyes open.*	Native English Idiom	LN	Fofana	110	2020
14	The woman was trying *to put fire between us.*	The woman was trying *to steer conflict between us.*	Local Idiom	TD	Conteh	183	1997
15	One time in an august gathering in the Court Barrie, the chairman, *a son of the soi*l said…	One time in august gathering in the Court Barrie, the chairman, *an indigene said…*	Local Idiom	TND	James	17	2016
16	So much so that the boy and the girl started *seeing themselves as*	So much so that the boy and the girl started *treating each other as husband and wife.*	Local Idiom	MJ	Sesay	49	2017

	husband and wife.						
17	Mr. Foday, the class five teacher, caught part of the *gossipers'* conversation.	Mr. Foday, the class five teacher, caught part of the *gossips'* conversation.	Innovation	WItB	Sesay	24	2019
18	Fanday has obtained permission from her husband to go to a town called Gbendembu to arrange for a prominent *Gbatorman* to come and search for the money	Fanday has obtained permission from her husband to go to a town called Gbendembu to arrange for a prominent *soothsayer* to come and search for the money	Aboriginal Word	ISS	Conteh	109	2007
19	Apart from being a ranking member of the *poro society,* Momoh Senesie was also a ranking member of other *medicine societies.*	Apart from being a ranking member of a *male society*, Momoh Senesie was also a ranking member of other medicine societies	Aboriginal Word	GC	Kroma	95	2010
20	This of course offended the *Bondo society*	This of course offended the *female secret society*	Aboriginal Word	GC	Kroma	161	2010

TABLE 2. The Grammatical Peculiarities of Sierra Leonean Authors

No	Peculiarity	British equivalent	Classification	Text	Author	Page	Date
1	On the threshold of each dawn, she would cross the interception of roads that met at a right angle nibbed at the edge of unpaved *drainages*.	On the threshold of each dawn, she would cross the interception of roads that met at a right angle nibbed at the edge of unpaved *drainage.*	Number	LM	Sesay	10	2015

2	He always took me around with him, making me draft reports and write *correspondences* for me to sign.	He always took me around with him, making draft reports and write *correspondence* for me to sign.	Number	G	Hallowell	13	2012
3	Alhaji had many friends whose *characters* were the direct opposite.	Alhaji had many friends whose *specks of character* were the direct opposite.	Number	WItB	Sesay	55	2019
4	But who was to give such *an advice*?	But who was to give such *a piece of advice*?	Number	MBC	Thompson	21	2012
5	Don't you know the saying witches *know themselves?*	ct	Pronoun Usage	TD	Conteh	110	2007
6	One thing people did not like about Ndawa's prophecies *were* his sacrifices	One thing people did not like about Ndawa's prophecies *was* his sacrifices	Concordial Verb	ISS	Conteh	110	2007
7	Where *is* my wife and child, and how could I contact them?	Where *are* my wife and child, and how could I contact them?	Concordial Verb	TV	Kamanda	11	2007
8	By the end of the fourth year, he with four others from Bandajuma *were* recommended for…	By the end of the fourth year, he with four others from Bandajuma *was* recommended for …	Concordial Verb.	GC	Kroma	24	2010
9	… but my family made my goals *looked* foolhardy	… but my family made my goals *look* foolhardy	Tense Usage.	TRK	Hallowell	110	2015

10	I forced my way forward to the center of the crowd where the boy *laid* from the …	I forced my way forward to the center of the crowd where the boy *lay* from the …	Tense Usage	FA	Sheriff	52	2012
11	My bones are *aching*.	My bones *ache*	Tense Usage	ISS	Conteh	133	2007
12	A tire exploding in the furnace made him *to jump* splattering the coffee all over himself.	A tire exploding in the furnace made him *jump* splattering the coffee all over himself.	Infinitive	TLSN	Hallowell	15-16	2012
13	He had been near death and ceased *to trust* his fellow men, so he scorned all human warmth along the way.	He had been near death and ceased *trusting* his fellow men, so he scorned all human warmth along the way.	Infinitive /Participle	LM	Sesay	43	2015
14	The only thing that Mama Yatta thought important was that Tenneh should have a baby *for* Gibao.	The only thing that Mama Yatta thought important was that Tenneh should have a baby *with* Gibao.	Prepositional Usage	TD	Conteh	184/189	1997
15	… but for some missionaries, I might have been *on* the street by now	… but for some missionaries, I might have been *in* the street by now	Prepositional Usage	JCM	Hunter	115	2013
16	As stated, Ebola never reached *at* Mabanta.	As stated, Ebola never reached Mabanta.	Prepositional Inclusion.	PFPMB	Tarawallie	295	2019
17	… frequently offer him things he did not request *for*.	… frequently offer him things he did not request.	Prepositional Inclusion	GC	Kroma	49	2010
18	She woke from the sleep and	She woke *up* from the sleep	Prepositional Omission.	FRSL	Hinzen	36	1987

	patiently waited for the two days to elapse.	and patiently waited for the two days to elapse.					
19	I have no business in *that of your* church.	I have no business in *your* church.	Determiner Usage.	CGW	Gboyor	85/88	2018
20	*This of her* sister's sound reasoning beats her.	*Her* sister's sound reasoning beats her.	Determiner Usage.	CGW	Gboyor	97	2018
21	… before taking the risk of boarding a vehicle to go into an oblivion for over *one* year in Mabanta.	… before taking the risk of boarding a vehicle to go into an oblivion for over *a* year in Mabanta.	Determiner Usage.	PFPMB	Tarawallie	260	2019
22	Kakpindi was not in *a* haste to get up and move over to acquire what it was all about.	Kakpindi was not in haste to get up and move over to acquire what it was all about.	Determiner Inclusion	CGW	Gboyor	110	2018
23	*Majority* of them, especially the men, came with the looted goods which they are selling to people.	*The* majority of them, especially the men, came with the looted goods which they are selling to people.	Determiner Omission.	CGW	Gboyor	75	2018
24	… and the frustration of losing his wife when he wanted her most.	… and the frustration of losing his wife when he wanted her *the* most.	Determiner Omission.	TRK	Hallowell	121	2015
25	It was amazing when I found out that students were *fast* to learn French than I was doing.	It was amazing when I found out that students were *faster* to learn French than I was doing.	Adjectival Usage.	HST	Sheriff	57	2020
26	One night, nine months	One night, nine months ago, a	Word Class.	FA	Sheriff	60	2012

	ago, a grenade exploded in our house, tore my *nine – months'* daughter into pieces.	grenade exploded in our house, tore my *nine – month* daughter into pieces.					
27	When first we met, I hoped I would have an *able* helper in my chosen task.	When first we met, I hoped I would have an *abled* helper in my chosen task.	Word Class	TRF	Hunter	117	1982
28	I got a degree in 1962 and *the book was published in 1965.*	I got a degree in 1962 and *the publishers published the book in 1965.*	Syntax	TFB	Jones	65	2012
29	Haja Memuna was a well-known fishmonger both in Freetown and *the provinces.*	Haja Memuna was a well-known fishmonger both in Freetown and *in the provinces.*	Syntax	WItB	Sesay	50	2019
30	We caused the wide – eyed creatures to start gibbering widely either in excitement *or alarm* and …	We caused the wide – eyed creatures to start gibbering widely either in excitement *or in alarm* and …	Syntax	TRF	Hunter	105	1982
31	Many believed that Gbegima and Mattia were afraid to take risk rather than *go search* for great wealth in the diamond field.	Many believed that Gbegima and Mattia were afraid to take risk rather than *to go search* for great wealth in the diamond field.	Syntax	TD	Conteh	21	1997
32	How could Gibao a man who has told them some time ago about his disgust and dislike for the	How could Gibao a man who has told them some time ago about his disgust with and dislike f or	Syntax	TD	Conteh	22	1997

	callous attitude of people towards the dead.	the callous attitude of people towards the dead.					
33	Scarcely had he finished his last statement *than* the towns people returned with rebels.	Scarcely had he finished his last statement *when* the town people returned with rebels.	Syntax	FA	Sheriff	55	2012
34	Although he is not educated, *but* he is nevertheless very proud of his job.	Although he is not educated, *yet* he is very proud of his job.	Syntax	CGW	Gboyor	109	2018
35	Your father is dead, *not so?*	Your father is dead, *isn't he?*	Syntax	TD	Conteh	209	1997
36	You have a permit to reside here?	Do you have a permit to reside here?	Syntax	TD	Conteh	225	1997

Data Analysis

This section deals with the causes of the peculiarities presented above. With regards to the lexical peculiarities, it can be noted that in Standard British English words have their specific pairs with which they collocate. For example, the word 'different' often collocates with the preposition 'from'. This situation is different in American English where the adjective collocates with 'than' (Trudgill and Hannah, 1985 and Todd, 1987,88). It would appear that the author who has lived in America for some time is transferring the usage common in America in this context. The second and third peculiarities are concerned with words which occur in English and Krio as cognates. This means that since Krio has borrowed some English words there are some borrowed Krio words in English with a different contextual usage. Hence it is that the meaning which 'hang' and 'head' and 'turn' and 'head' are contextually different.

The next category of difference in meaning shows how culture influences the meaning of English words in Sierra Leone. For example, 'woman damage' is a cultural practice where a man who has an affair with a married woman is required to pay a fine (see the fourth peculiarity). The next category of peculiarities in this section refers to objects which are restricted to the Sierra Leonean culture. A 'chewing stick' (see the fifth peculiarity) is used in Sierra Leone to brush one's teeth. Moreover, a 'witch plane' (see the sixth peculiarity) is believed to be used by both witches and wizards to travel to far and near places to carry out their diabolic acts.

With regard to the extension of the meanings of words, Krio the unofficial lingua franca in Sierra Leone, has contributed for words to have different senses. For example, it can be noted that an awe inspiring event can appear 'big' in someone's eyes (see seventh peculiarity), a living thing like a non-living thing, can go down the surface of a river or sea (see eighth peculiarity). and the verb 'move' now has an additional meaning which can involve people to walk 'to a new place to work or operate' (see the ninth peculiarity).

In the tenth peculiarity, 'popular' is used in a positive sense though according to the sentence it is the negative meaning that is intended. This is shown when a village that is associated with black magic is described for this feature rather than being censored.

The further category of peculiarities shows how idioms are modified in Sierra Leone. For example, as 'writings on the wall' (see the eleventh peculiarity) refers to signs that something unpleasant or unwelcome is going to happen (Oxford Dictionary of Idioms, 1999, 320), the writer tends to add the 's' plural marker in analogy to the use of the noun 'signs' which is shown in the meaning. Moreover, in the twelfth idiom, the Sierra Leonean idiom depicts an omission in the original British idiom 'to wipe a smile in each other's face' wherein both the verb 'wipe' and the definite article 'the' are omitted. Finally, the thirteenth peculiarity shows reduction and replacement of the British idiom. That is, in the idiom 'with eyes open' the preposition 'before' replaces 'with' and the adjective 'open' is omitted. However, the meanings of the aforementioned idioms remain the same as their use in British English in spite of the changes or distortions that have taken place in them. The second group of idioms involves those that are borrowed from the Sierra Leonean languages (see 14-16 peculiarities). For example, 'to put fire between people' (see the fourteenth peculiarity) is a Krio idiom which means to steer conflict between people or to make them quarrel. The fifteenth idiom 'son of the soil' is also borrowed from Krio and other Sierra Leonean languages and it means an indigene in a locality. Finally, the sixteenth idiom 'husband and wife' is used in Sierra Leonean languages to refer to a situation where a man and a woman have started having sex.

The seventeenth peculiarity is related to analogy. For example, the 'er bound morpheme' is used to refer to the doer of an action. In this case, the morpheme is attached to the verb 'gossip' to refer to a gossip. The last category of peculiarities refers to nouns which are restricted to the Sierra Leonean environment. A 'gbatorman' (see the eighteenth peculiarity) is someone with mystical powers who is believed to reveal what the ordinary man cannot. Both the nineteenth and twentieth peculiarities respectively refer to male and female secret societies which exist in Sierra Leone. In this subsection it can be noted that English acculturates to accommodate words that are peculiar to the Sierra Leonean or by extension African society. Guptar illustrates this phenomenon which has developed among second language users when they are using the targeted language as follows: "it is inevitable that local standards develop wherever English is used for local culture" (1999,8).

The above discussion shows that the lexical peculiarities can be traced to factors such as differences in native English, learning induced, overgeneralization, first language induced and cultural induced sources.

The grammatical related peculiarities involve noun, pronoun, verb, adjective, determiner, preposition, word class and syntax related peculiarities. In the first place it will appear that Sierra Leoneans tend not to make a distinction between count and mass nouns. For example, in Standard British English mass nouns do not form their plurals by taking 's' or 'es' bound morphemes. This rule contrasts the one shown in the third peculiarity above. In the first peculiarity, there is a semantic relation between an uncountable noun and its semantic counterpart. For example, 'gutter and letter' are countable nouns which are respectively synonymous with their uncountable pairs namely 'drainage' and 'correspondence'. This accounts for the first and second peculiarities above Swan states that to form plurality 'we can use a word for a piece or unit together with of before an uncountable noun' (2016,121).

Moreover, a noun can either function as a countable or an uncountable noun based on the context in which it is used. For example, 'advice' can be regarded as an uncountable noun when it means 'an opinion or a suggestion about what somebody should do in a particular situation' (Hornby, 2020,24). Because it is uncountable, Hornby recommends that 'we say a piece of advice not an advice' (2020,24). This accounts for the fourth peculiarity above.

The fifth peculiarity shows that Sierra Leoneans tend to use the reflexive pronoun where the British writer will prefer the reciprocal one. This peculiarity may be as a result of the substitutional role which the reciprocal pronoun plays to replace the reflexive pronouns in some Sierra Leonean languages. For example, in Krio in the sentence,

'Salon pipul dem lek den sef'

Literal translation: 'Sierra Leoneans love themselves';

Meaning: 'Sierra Leoneans love each other/one another'. This peculiarity can be attributed to first language transfer.

The sixth, seventh and eighth peculiarities are related to the different use of concord. The sixth peculiarity appears complex to the Sierra Leonean writer. In Standard British English, the verb normally agrees with the subject of a sentence not with a following complement. However, in this peculiarity it is the complement that influences the verb rather than the subject. In the seventh peculiarity, the Sierra Leonean may not tend to use the appropriate verb because the verb precedes the subject which makes it difficult for him to identify the subject easily. In the eighth peculiarity, the Sierra Leonean writer correctly identifies the subject of the verb but does not use the correct verb by his failure to follow the native English rule which states that when a singular subject starts a sentence, the verb should take a singular form. The peculiarities in this section are therefore due to incomplete application of target language rule restriction.

The ninth peculiarity is related to the use of tense. Standard British English requires the use of the bare infinitive after the use of the verb 'make'. It would appear that the writer is not aware of this target language rule.

The tenth peculiarity is caused by the writer's inability to distinguish the difference between the verb 'to lie' which means to recline and the verb 'to lay'. The former is an intransitive while the latter is transitive. The peculiarity therefore occurs because the writer does not know that the past form of 'to lie' which means to recline is 'lay' which is intransitive and not the reverse. The peculiarity is therefore learning induced.

The eleventh peculiarity shows the distinction between stative and dynamic verbs. Carter and McCarthy (2006) list the situations where the present progressive is rarely used to show the distinction in English. The peculiarity is therefore learning induced.

The twelfth peculiarity is concerned with the Standard British English rule which deals with the use of the infinitive without to. Swan highlights the communicative English rule which states that 'verbs that express perception and causation like 'make' are followed by object with an infinitive without to' (2016,91). The Sierra Leonean writer seems unaware of this English rule. The peculiarity is therefore learning induced.

With regard to the thirteenth peculiarity, it can be noted that both the participle and the infinitive can occur after a verb. This can, however, occur with a change of meaning. Therefore, the use of

the participle after the verb 'cease' is contextually wrong as it suggests the end of an activity rather than the change of an activity. The peculiarity is therefore learning induced.

The fourteenth and fifteenth peculiarities involve differences in prepositional usage. When a child is born in Sierra Leone, the ownership of that child customarily rests on the father. This accounts for the use of the preposition 'for' in the fourteenth peculiarity. This situation is different from what obtains in Western countries like Britain where the ownership of the child is shared as seen in the use of the preposition 'with' above. The fourteenth peculiarity is therefore culturally induced. The fifteenth peculiarity is as a result of the differences in American and British English. Trudgill and Hannah illustrate this when they state that English English tends to use 'to live in a street' while American English tends to use 'to live on a street' (1985,68). It can be inferred from the above that although the writer - Hunter- completed her studies in the United Kingdom, the tendencies highlighted above exist in both sides of the Atlantic.

The sixteenth and seventeenth peculiarities can be attributed to the overgeneralization of target language rule. This is because the English verb 'arrive' collocates with 'at', it is assumed that a synonymous pair which requires the same preposition even though this is not required in native English. This accounts for the sixteenth peculiarity above. Also, because the verb 'ask' collocates with the preposition 'for', the writer tends to use the same preposition for its synonymous pair 'request'. This can be seen in the seventeenth peculiarity above.

The eighteenth peculiarity which tends to deal with prepositional omission can be related to the relatively few prepositions in the local languages of Sierra Leone. This can be seen in the following example in Krio:

'a wek na net'

Literal translation: 'I woke at night.

Meaning 'I woke up at night'.

In this Krio sentence the preposition 'up' which collocates with the verb 'wake' is omitted. The peculiarity is therefore first language induced.

The nineteenth and twentieth peculiarities are related to determiner usage. Mende, the tribe with highest population in the country (Statistics Sierra Leone, 2015,25), demonstrates determiner usage as follows:

'bi nde na' literal translation: 'your sister that of'

'bi sosi na' literal translation: 'your church that of'

It could be noted that whereas native English uses the possessive determiner which is followed by a noun, in Mende the noun is preceded by the determiner and followed by the article. The nineteenth and twentieth peculiarities are therefore first language induced.

The twenty-first peculiarity shows that the indefinite determiner is replacing the definite article. This peculiarity is also first language induced because it is borrowed from Krio as shown in the following sentence:

'a see wan bobor yesterday'

Literal translation: 'I saw one boy yesterday'

Meaning: 'I saw a boy yesterday'.

The twenty second peculiarity shows that Sierra Leoneans do not distinguish the use of countable and uncountable nouns. For example, an indefinite article cannot precede an uncountable noun when it is singular. This peculiarity is therefore learning induced.

The twenty third and twenty fourth peculiarities are related to the omission of the article. A definite and indefinite article are considered mandatory in starting phrases. For example, the word 'majority' requires the article in native English. This is responsible for the twenty third peculiarity above. Furthermore, the superlative is invariably preceded by the definite article (Carter and McCarthy 2016, 773). It would appear that this rule is not observed by Sierra Leonean languages as is seen in the following Krio sentence.

'a sabi rait pas dem ɔl'

Literal translation: 'I can write better than all of them'

Meaning: 'I am the best writer'

With regard to the twenty fifth peculiarity, it can be noted that in native English comparative forms of adjectives should precede the subordinating conjunction 'than' (Raymond Murphy,208). However, in Sierra Leonean languages the adjectives are not inflected as is shown in the following Krio sentence:

'di bobor gladi pas mi'

Literal translation: 'the boy is happy than me'

Meaning: 'the boy is happier than me' which shows that the twenty fifth peculiarity is first language induced.

The twenty sixth and twenty seventh peculiarities are related to Sierra Leonean's use of word classes. It is clear that the writers are aware of how plural nouns are formed. However, they do not know that this form changes when the noun functions as an adjective. This is what happens in the twenty sixth peculiarity. As for the twenty seventh peculiarity, Sierra Leoneans are aware about the use of the 'ed' bound morpheme to form adjectives. However, this does not apply to the word 'able' in the twenty seventh peculiarity. The two peculiarities are therefore called overgeneralization of native English rules.

The peculiarities ranging from twenty-eight to thirty-one are concerned with the use of parallel structures. Native English rules state that writers should balance parallel ideas linked with the correlative conjunction. This means that when ideas that are closely parallel in content, they should be expressed in parallel grammatical form (Hacker, 1991, 121). This rule is not followed because in the twenty eighth peculiarity a coordinating conjunction links a verb in the active voice and another in the passive voice. Moreover, the twenty nineth and thirtieth peculiarities are concerned with structures which occur in pairs. The Native English rule states that 'the grammatical structure following the second half of the pair is the same as that following the first half' (Hacker- 123). This rule is not followed in the twenty-nineth peculiarity where 'both' is followed by a prepositional phrase and 'and 'is followed by a noun phrase. The same situation occurs in the thirtieth peculiarity where' either 'is followed by a prepositional phrase and' or' is followed by a noun. It would appear that the three peculiarities in this section are caused by ignorance of Native English rules. Standard English rule also states that the writer or speaker

should balance comparisons linked with than or as. This means that the elements being compared should appear in parallel grammatical structure. This rule is not observed in the thirty first peculiarity as one of the elements being compared is the infinitive with to (to take risk) and the other is the infinitive without to (go search).

The thirty second peculiarity involves the omission of words in a compound structure which contains 'disgust' and 'dislike '. It can be seen that 'disgust' collocates with 'with' but this cannot be applied to 'dislike'. Therefore, they are not common to both parts of the compound structure. The thirty third and thirty fourth peculiarities are concerned with the use of inappropriate conjunctions. For example, in Native English the conjunction 'although' collocates with the coordinating conjunction 'yet' rather than 'but'. Moreover, the adverb 'scarcely' collocates with the conjunction 'when' rather than 'than'. The thirty third and thirty fourth peculiarities are therefore learning induced.

The last two peculiarities are first language induced. For example, while Native English uses the appropriate helping verbs in question tags, the local languages ask questions by using invariant pattern as is shown in the thirty fifth peculiarity. Finally, the thirty sixth peculiarity shows that while Native English uses the inverted forms to ask questions, the local languages in Sierra Leone use the declarative form followed by rising intonations to ask questions.

From the above, it can be noted that the grammatical structures in Sierra Leone are influenced by structures in Standard British English, first languages in the country, overgeneralization of target language rules and learning induced factors.

Conclusion

It can be observed from the above that what has been described as errors are now becoming systematic features of Sierra Leonean English. This seems to be the main source for the development of the new Englishes in the world. For example, Burageya (2021,217-218) cites Hocking (1974) who discusses the errors in East African English. In his conclusion, Hocking makes the following statement to teachers of English with regard to their learners' mistakes: 'it is possible that we may eventually develop a local East African form of English ourselves, and if we do, it may be that some of the mistakes we are dealing with in this book will be part of it' (1974, 59-60). Gut also shares a similar sentiment when he states that, 'errors can persist until they become recognized as legitimate features of a given variety of English' (2011, 21). However, in Sierra Leone this realization has not been captured by many of the academics in the country. For example, Sesay admits that with regard to the English usage of her students, she is 'oppressed by her sense of overwhelming frustration' (1983, 1) and she states in her PhD thesis that the errors from university students in Sierra Leone, 'is born of the frustration of (her own situation as a teacher)' (1983, 1). Some of the errors she highlights in her thesis include the following:

1. He told me to <u>board</u> the car. (1983, 333)
2. We had to ask for temporary <u>accommodations</u>. (1983, 164)
3. She did promise to <u>marry to</u> me by Xmas. (1983, 338)

She respectively categorises the above errors as showing instances of wrong collocation, wrong number, and wrong idiom, and the correct versions which she provides are, 'get into, accommodation, and to marry me' respectively. Interestingly, Sesay regards as errors whatever is not part of British English. That is why even though she recognizes that 'accommodations' is acceptable in American English (1983, 169) and to board the car 'could have been influenced by

American usage' (1983, 336), she considers them as erroneous structures. Moreover, with regard to the third 'error' in English culture, we can talk of a man marrying a woman or a woman marrying a man or a man and a woman being married to each other. This is shown among others in the works of Sierra Leonean academics resident in the United States of America and Germany as is respectively shown in: 'Fina (a female character) wants to marry him' (Hollist, 2011), and 'Andrew, our Sierra Leonean brothers are so thankful to the German women who marry them' (Hybrid Eyes Reflections of an African in Europe, Sankoh, 2016,80). In Sierra Leone, like the rest of Africa, to marry is used only in reference to the man while the equivalent to be married is used only in reference to the woman. Culturally speaking, it is only men who marry while women get married. Moreover, the frustration expressed by Sesay is reechoed by Osho who in his proposal for the English Language programme – Foundation Studies – states that he finds, 'it difficult to sleep easily' for 'the deterioration in competence of (our) students and children in (our) school system in English usage' (2007, 1). Fifteen years later, he expresses the purpose for writing his book where he states that 'good examples of the use of English in our country and West Africa are increasingly hard to come by nowadays' identifying the source of the problem to be 'the media which one would have looked to for guidance has unfortunately not played a leading role' (2022, vi).

Significantly, Osho's position is different from that of Pemagbi who when he is faced with the problem of having teaching and learning materials in a rural university recalls his school teacher's advice that newspapers and the radio 'can enrich your language' (1995, 55). More importantly perhaps, in A survey of Sierra Leonean English, Turay dedicates his study ''to the journalists, lecturers and students of English in Sierra Leone who have amply demonstrated there is an English variety in the country which [Sierra Leoneans] can proudly describe as [theirs]' (2025, i). It is possible that the Sierra Leonean authors cited above can also be included in Turay's dedication. Ironically, these writers include James' 'The New Disease' and Siaka Kroma's 'Gomna's Children' whose texts have been currently prescribed for candidates at the Basic Education Certificate Examination (BECE). Osho comments on both texts which will be of interest to Sierra Leoneans and other academics. In 'The New Disease', he states that 'The language is simple but at the same time introduces pupils to new vocabulary which are easily digestible' (2016, ii). Similarly, in 'Gomna's Children' he comments that, 'the novelist's simplicity of language, directness of presentation and unwavering focus on the issues at hand make the novel suitable for study at different levels' (2010, iv-v). with these statements coming from a distinguished language guru in Sierra Leone, 'Former Senior Lecturer, Department of Language Studies, Former Head of the Department of English, Former Head of the Department of Language Studies, Fourah Bay College, the Former Director of Confucious Institute, the University of Sierra Leone (James, TND,2016 i , Kroma, 2010, XVI, one should not be surprised when the two texts were included in 2023 by the West African Examination Council for the Basic Education Certificate Examination in Sierra Leone). The Sierra Leonean authors have shown that language purists cannot change the narrative as stated by Fromkin and Rodman, '(N)o academy and no guardians of language purity can withstand language change, nor should anyone attempt to do so since such change does not mean corruption' (2006, 409). This brings us to the situation of the young second language learners in the country. To improve on their English usage, these learners are encouraged to read both from within and from outside their prescribed texts. This is where the importance of reading newspapers, magazines and other texts comes in. By heeding this advice, such learners may come across words and expressions which are considered erroneous in native English. This has happened in several non-native English settings. For example, the distinguished Nigerian laureate Soyinka while presenting the theme of clash of cultures in 'The Lion and the Jewel', uses the non-English word 'bride-price' six times instead of 'trousseau' and the word 'dowry' once in his sixty-two page text 'Dowry' means 'money and/or property that in some societies a husband will pay

to his wife's family when they get married' (Hornby 2020, 450). This word is influenced by the Nigerian culture. This influence is also evident in Sierra Leone and other African countries. Whenever such words are used, the teacher should not consider them wrong as they are part of the students' culture. This brings us to the status of West African candidates in English over the years. It can be noted that a Chief Examiner's report may have expressions which may be considered erroneous in standard English. Consider the following examples:

- 'Majority of candidates displayed a good knowledge of the format and style of the informal letter and of story writing' instead of 'the majority' (2020, 78) cf. 23 see page 11 above and see Buregeya (2021, 73 – 74 Kenyan English) and Dako (2008, 375 Ghanian English).
- 'Indiscriminate use of wrong tenses and too many errors in punctuation and spelling' instead of 'indiscriminate use of tenses. (2020, 78).

With regard to the questions set for the examination, that is both the West African Senior School Certificate Examonation (WASSCE) and the General Certificate Examination (GCE) that precedes it, there have been instances of language errors as can be seen below:

- 'For us to accomplish the task successfully, all hands must be on deck' instead of 'all hands-on deck' (SSCE, November 1990, 21, English Language 2, Objective Question), (Kolawole 2005, 21).
- Chike escapes the accident by a hair breadth' instead of 'hair's breadth' (SSCE November 1989, 13, English Language 2, Objective Question), (Kolawole 2005, 21).
- 'At the last minute, he developed cold feet.' Instead of 'he had | got cold feet' (West Examination Council 2015, 9). |

From the above 'errors' and those that are identified in the Sierra Leonean texts above, one could infer that some of our academics in the subregion ''seem to be running away from something that is already part of 'them'.'' (Pemagbi,1989, 20). This is partly responsible for the poor performance of WASSCE students in English over the years. For example, in 2022 it is recorded that 'over ninety per cent of the candidates scored OK zero for mechanical accuracy'. The same record was also made in 2023 (2023, 92). The report in 2024 was not less worrying as in addition to what was pointed above, 'candidates' essays were largely poor as a result of wrong concord, or no use at all of punctuation marks, wrong use of tenses, misuse of prepositions and articles, and poor knowledge of basic rules in Grammar' (2024, 102). The million-dollar question here is for how long should Sierra Leonean and by extension West African candidates continue to be penalized for 'errors' which even the setters of questions and/or examiners cannot get rid of? This is where the role of the Language Teachers' Association comes in.

Recommendations

1. One of the members of this association Jones who proves to be ahead of his time urged his colleagues to realize that 'nobody can predict the course of a language' (1965, 35). The Language Teachers' Association should be revived and members should ensure among other things that they are attuned to the writing of writers whose works reflect the language usage in the country. This is because good English should not be limited to only what obtains in the classrooms. Therefore, as the language continues to develop, 'the teacher should not mark wrong any local form in popular usage but accept and give the child the standard British equivalent' Pemagbi (1992, 36).

2. Moreover, while the local form should not be penalized, teachers should also focus on the standard English variety which Strevens defines as '…a particular dialect of English, being the only localized dialect of global currency without significant variations, invariably accepted as the appropriate educational target in teaching English' (1983, 88). With this

exposure, Sierra Leonean candidates will be able to speak and write the English language which can be understood by not only their compatriots but also by users of English in other countries. This implies that teachers should not tolerate blatant errors which can be comprehended by their compatriots but have the potential of blurring communication with users of English from other countries.

3. Finally, it can be noticed that teachers of English have been insisting on consistency while marking their candidates' scripts. This means that if for example a candidate uses an expression that is typical of American English usage, his or her expression will be accepted. However, the same candidate will be penalized if he or she later switches to British English usage.

4. It is recommended that since the world now recognizes the development of world Englishes, the focus for correct English usage should not be limited only to the established varieties. This means that a word or expression in Sierra Leonean English and the one from Britain should both be accepted as correct usage.

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ANALYSIS OF DOG TICK DISTRIBUTION IN NIGERIA

Onaopemipo Oluwaseun Fabunmi
Department of Veterinary Surgery and Radiology,
Faculty of Veterinary Medicine, University of Ibadan,
Ibadan, Nigeria
Email: *fabunmionaopemipo@gmail.com*

Abstract
Dog tick infestation is a global phenomenon that could pose threats to the environment, animals and humans but reports about their distribution across Nigeria remain sparse. Thus, there is a need to investigate and have updated report about tick infestation on dogs in Nigeria.
Using a cross-sectional study, ticks were randomly collected from dogs of known age, breed and sex across Nigeria. Harvested ticks were identified to species level using standard morphological keys noting the developmental stages and sex if the ticks. Data obtained were analyzed using descriptive statistics presented as percentages and inferential statistics to determine association between infestation and studied variables, with p-value <0.05 taken as significant.
A hundred and twenty dogs were gotten from 11 locations in Nigeria: Ogun, Oyo, Osun, Lagos, Kaduna, Kebbi, Benue, Sokoto, Taraba, Federal Capital Territory (Abuja), and Plateau. Out of the 120 dogs, 44.2% (53/120) and 55.8% (67/120) were male and females respectively. Exotic breeds of dogs were 46.7% (56/120) and 53.3% (64/120) were local. 1223 ticks were gotten from the dogs; Benue had the highest number of ticks, 21.4% (262/1223) and Lagos had the least, 2.5% (31/1223). Three genera of ticks were reported from this study grouped into the following species identified: Rhipicephalus sanguineus; 68.9% (843/1223), Rhipicephalus turanicus 12% (147/1223), Haemaphysalis leachii 14.3% (175/1223), and Amblyomma latum 4.7% (58/1223).
The diverse species of ticks demonstrated in this study are indicative of the need to find lasting solution to piroplasms, a consequence of ticks being vector borne diseases. Also, the presence of Rhipicephalus turanicus suggests that dog importation through the ports should be subjected to proper screening to control the introduction of new tick species into the country. Thus, further research is recommended for effective control of new species of ticks discovered, piroplasm management and proper tick control.

Keywords: Dog ticks, *Rhipicephalus, Rhipicephalus (Boophilus), Haemaphysalis, Canis farmilaris.*

Introduction
Ticks are obligate hematophagous arthropods belonging to the order Acari and are widely recognized as one of the most important vectors of pathogens affecting both human and animal health globally. Their medical and veterinary significance is largely attributed to their ability to transmit a wide range of infectious agents, including bacteria, protozoa, viruses, and rickettsiae (Gray *et al*. 2013; Dantas-Torres & Otranto 2016).

Ticks are classified into two major families: Ixodidae (hard ticks) and Argasidae (soft ticks). Hard ticks are of greater epidemiological importance due to their prolonged feeding duration, which increases the likelihood of pathogen transmission (Jongejan & Uilenberg 2004; Šlapeta *et al.* 2021).

Domestic dogs are among the most important hosts for ticks, particularly members of the *Rhipicephalus sanguineus* species complex, commonly known as the brown dog tick. This species is widely distributed in tropical and subtropical regions and is a competent vector of several clinically important pathogens, including *Ehrlichia canis*, *Babesia vogeli*, and *Anaplasma platys* (Gray *et al.* 2013; Akande *et al.* 2018). Its ability to complete its life cycle in domestic environments makes it particularly successful in urban and peri-urban settings.

Recent global studies have highlighted that tick populations and tick-borne diseases are expanding in distribution due to environmental changes, climate variability, and increased movement of companion animals across regions (Dantas-Torres & Otranto 2024; Giannelli *et al.* 2024). These changes have intensified the public health importance of ticks under a One Health framework, which integrates human, animal, and environmental health perspectives.

In Nigeria, *Rhipicephalus sanguineus* remains the most frequently reported tick species infesting dogs across different ecological zones (Konto *et al.* 2014; Akande *et al.* 2018). However, emerging reports have indicated the possible presence of other species such as *Rhipicephalus turanicus*, suggesting potential shifts in tick population structure and the introduction of non-native species through animal movement and trade. Nigeria is characterized by diverse ecological and climatic conditions ranging from the humid rainforests in the south to the savannah zones in the north. These environmental variations strongly influence tick survival, reproduction, and seasonal abundance. Studies have shown that tick populations are generally higher during rainy seasons due to favorable humidity and vegetation conditions (Arong *et al.* 2013).

Despite the close association between humans and dogs in Nigeria, surveillance data on tick distribution remain limited and fragmented, with most studies restricted to specific states or regions. This limits a comprehensive understanding of the national epidemiology of tick infestation in dogs. Furthermore, tick-borne diseases remain a significant but underdiagnosed public health concern in Nigeria, partly due to clinical similarities with other endemic febrile illnesses such as malaria and typhoid fever, as well as limited diagnostic capacity (Oguntomole *et al.* 2018). The growing importance of companion animals in zoonotic disease transmission, roles of dogs as zoonotic reservoirs and the need for integrated disease surveillance indicates a clear necessity for an updated and nationwide data on tick infestation patterns in dogs (Overgaauw *et al.* 2020; Haynes *et al.* 2024). Therefore, this study evaluated the distribution, species composition, and geographical distribution of ticks infesting dogs across selected geopolitical zones of Nigeria.

Methodology

A cross-sectional design was adopted for this investigation. The study was conducted across selected locations within four geopolitical zones of Nigeria: North-Central, North-West, North-East, and South-West.

A total of 120 dogs, comprising both indigenous and exotic breeds as well as pet and hunting dogs, were examined. Ticks were manually removed using sterile forceps and immediately preserved in universal sample bottles containing 70% ethanol.

The preservation solution was prepared by mixing absolute ethanol and distilled water in a 7:3 ratio to achieve the required concentration.

Specimens were cleaned using ethanol and cotton wool to remove debris prior to microscopic examination. Identification was performed using standard morphological keys under a compound microscope following Walker *et al.* 2014.

Data obtained was recorded in Microsoft Excel and analyzed using SPSS. Descriptive statistics such as frequencies and percentages were used to summarize infestation patterns across host and environmental variables.

Results

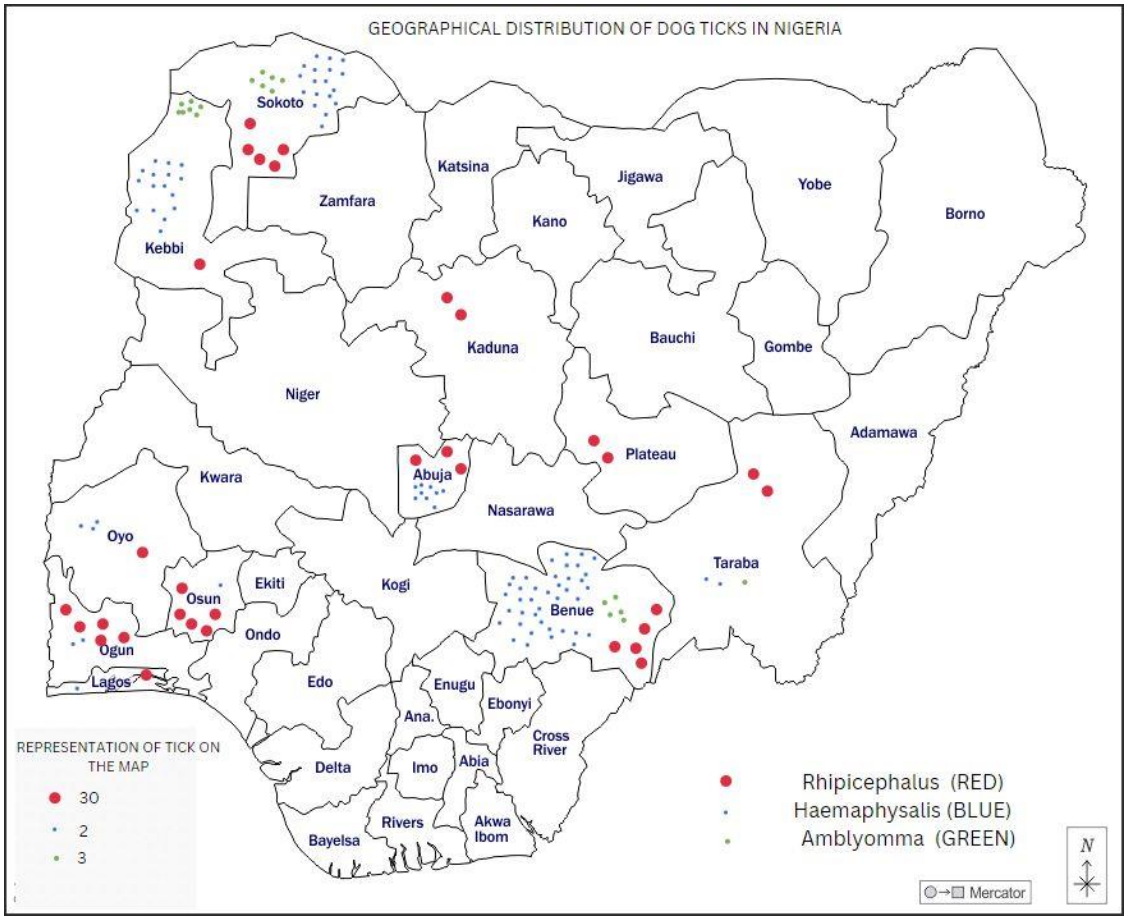


Figure 1: Geographical Distribution of Dog ticks in Nigeria.

A total of 1,231 ticks were recovered from 120 dogs, indicating that all sampled animals were infested.

Table 1: Host-related findings

s/n	Host	Frequency
1	Exotic breeds	53.7%
2	Indigenous breeds	45.7%
3	Puppies	56.6%
4	Adults	42.7%
5	Females	54.3%
6	Males	45.0%

Table 2: Developmental stages

s/n	Developmental stage	Frequency
1	Adult ticks	87.7%
2	Nymphs	11.3%
3	Larvae	1.0%

Adult ticks were most abundant (87.7%), followed by nymphs (11.3%) and larvae (1.0%).

Table 3: Species composition

s/n	Species Composition	Frequency
1	*Rhipicephalus*	80.5%
2	*Haemaphysalis*	14.1%
3	*Amblyomma*	4.7%

The dominant species was *Rhipicephalus sanguineus* complex, with *Rhipicephalus turanicus* detected.

Table 4: Geographical distribution

s/n	Geographical location	Percentage distribution
	North-Central	34.8%
	South-West	31.4%
	North-West	28.0%
	North-East	5.1%

At the state level, Benue recorded the highest infestation rate (21.3%), while Lagos recorded the lowest (2.5%).

Discussion

The findings reveal a consistently high level of tick infestation among dogs across the surveyed regions, suggesting widespread exposure to tick vectors in Nigeria. The dominance of the *Rhipicephalus sanguineus* complex aligns with its well documented adaptation to domestic environments and its close association with dogs (Gray *et al.* 2013; Baneth 2023). Its widespread occurrence has been reported across tropical and subtropical regions and is linked to its ability to complete its life cycle in indoor and peri-domestic settings. The detection of *Rhipicephalus turanicus* is of epidemiological concern, as it may indicate changes in tick distribution patterns or introduction through animal movement and trade networks (Šlapeta *et al.* 2021; Ogo *et al.* 2023). Recent taxonomic revisions emphasize that members of the *Rhipicephalus sanguineus* group are more diverse than previously assumed, and accurate identification may require molecular confirmation rather than morphology alone (Estrada-Peña *et al*. 2022).

Higher infestation levels observed in puppies may be attributed to immature immune responses and increased vulnerability to environmental exposure (Abdullahi *et al.* 2022; Usip *et al.* 2022). Similar patterns have been reported in previous studies across West Africa, where younger dogs consistently show higher tick burdens due to limited acquired immunity. Slightly higher infestation in females may reflect behavioral or physiological differences, although the variation was not statistically significant (Odeniran *et al.* 2021).

The observed geographical variation likely reflects differences in environmental humidity, vegetation cover, and climatic suitability for tick development. Higher infestation rates in the North-Central and South-West zones may be associated with favorable ecological conditions that support tick survival and reproduction cycles (Arong *et al.* 2013; Usip *et al.* 2022).

Overall, the high prevalence of adult ticks indicates active transmission potential and raises concerns regarding the risk of tick-borne infections in both animals and humans, consistent with global trends in tick expansion under changing environmental conditions (Giannelli *et al.* 2024).

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LECTURERS' INTEGRATION OF TECHNOLOGY-BASED ASSESSMENT FOR SUSTAINABLE MANAGEMENT OF INSTRUCTIONAL PRACTICES IN PUBLIC UNIVERSITIES IN ANAMBRA STATE

Prof. Vivian N. Nwogbo
Department of Educational Management and Policy
Faculty of Education, Nnamdi Azikiwe University, Awka
vn.nwogbo@unizik.edu.ngvivianwogbo@yahoo.com
08033845177

Prof. Becky U. Onuh
Department of Educational Management
Faculty of Education, Tansian University, Umunya
becky.onuh@tansianuniversity.edu.ng;onuhuchenna@yahoo.com
08038676373

Dr. Victor U. Agogbua
Department of Educational Management and Policy
Faculty of Education, Nnamdi Azikiwe University, Awka
vu.agogbua@unizik.edu.ng
08033031492

Dr. Elizabeth I. Anierobi
Department of Educational Foundations
Faculty of Education, Nnamdi Azikiwe University, Awka
ai.anierobi@unizik.edu.ng; lizzyanierobi608@gmail.com
08035953464

Dr. Scholarstica O. Okafor
Department of Educational Foundations
Faculty of Education, Chukwuemeka Odumegwu Ojukwu University, Igbariam
so.okafor@coou.edu.ng
07037079733

Abstract
This study investigated lecturers' integration of Technology-Based Assessment (TBA) to support sustainable management of instructional practices in public universities in Anambra State, Nigeria. Four research questions guided the study. The study adopted a descriptive survey research design. The study population comprised all 3,247 lecturers at the two public universities in Anambra State.A sample of 974 lecturers was selected from the population using a multistage sampling procedure. A 40-item self-structured questionnaire titled "Lecturers' Integration of Technology-Based Assessment for Management of Sustainable Instructional Practices Questionnaire (LITBAMSIPQ)" and rated on a 4-point scale was used for data collection. Both the validity and reliability of the questionnaire were established. Findings revealed, among others, that only a few TBA tools, such as Computer-Based Tests (CBT), Google Forms, Learning Management Systems (LMS) like Google Classroom, Zoom, or Microsoft Teams, and Turnitin plagiarism detection software, were utilized by lecturers for sustainable management of instructional practices in public universities in Anambra State. However, the extent of integration

remained relatively low. Among the recommendations proffered included that the University management, administrators and government agencies in partnership with non-governmental organizations (NGOs) and financial institutions should provide adequate funding and improved ICT infrastructure to enable lecturers facilitate utilization of these TBA tools.

Keywords: Technology-Based Assessment, Sustainable Instructional Practices

Introduction

Technology has been making a significant and positive impact in different sectors of the economy across nations of the world, including the Nigerian education system. Nowadays, many educational institutions across African nations are incorporating emerging digital technologies into the management of educational practices and processes. With globalization, universities are expected to integrate technology-driven approaches into instructional management and assessment systems to improve educational effectiveness, quality assurance, and sustainable learning outcomes (UNESCO, 2023). Since education remains a fundamental instrument for nation-building, national development, social change, and economic sustainability, as indicated by the Federal Republic of Nigeria (FRN, 2014) in the National Policy on Education (NPE), there is a need for technological advancement and its appropriate integration into instructional practices in public universities.

The integration of technology into educational practices has transformed the global higher education system in the twenty-first century. Consequently, universities are expected to adopt technology-driven approaches that enhance instructional delivery, learning processes, communication systems, assessment practices, research, and educational management. Therefore, public universities must give serious consideration to the effective integration of technology into their educational and operational practices to meet the demands of the contemporary knowledge society. Lam (2016) noted that among the various technology-driven approaches in universities, technology-based assessment has become important in facilitating the evaluation of students' learning outcomes and academic performance.

Assessment constitutes one of the major components in the management of instructional practices because it enables lecturers to evaluate students' academic progress, monitor learning outcomes, determine instructional effectiveness, and provide feedback for continuous improvement. As described by Siti et al. (2025), assessment involves the active participation of students in self-directed learning to improve the learning process. It is also a useful tool for monitoring and evaluating students' learning and academic progress in the attainment of instructional goals and objectives. Traditionally, assessment practices in universities relied heavily on paper-and-pen examinations, manual grading systems, physical assignments, and face-to-face evaluations. However, rapid technological advancement has altered these conventional approaches. With the integration of technology into education, assessment practices have taken a new dimension, leading many universities to adopt Technology-Based Assessment (TBA) to improve efficiency and effectiveness in instructional management.

Technology-Based Assessment (TBA) includes computer-based tests, electronic assignments, automated grading systems, online feedback systems, learning management systems, online assignment submission platforms, and interactive educational applications utilized to facilitate assessment and instructional management in educational institutions (Redecker& Johannessen, 2013). TBA enhances assessment flexibility and efficiency in instructional practices management. Similarly, Wiliam (2011) explained that technology-enhanced assessment supports formative learning by enabling timely feedback, data-driven instructional decisions and continuous

monitoring of students' academic development. The increasing dependence on digital learning environments has further necessitated the need for lecturers to integrate technology-based assessment into sustainable management of instructional practices. According to UNESCO (2023), the pandemic showed the importance of digital learning infrastructures and technology-enhanced assessment systems for sustaining educational activities during disruptions.

Thus, integration of TBA in instructional practices is relevant because lecturers can administer continuous assessment and examinations electronically, supervise students' projects, provide automated feedback, promote self-directed learning, and improve student engagement (Siti et al., 2025). TBA supports sustainable management of instructional practices by improving effectiveness, accountability, efficiency and accessibility in university education systems. In the view of OECD (2021), technology-enhanced assessment improves educational quality and instructional practices by supporting learner-centered instruction, personalized feedback, and data-driven decision-making. Most empirical studies have also shown that digital assessment platforms improve students' engagement, promote active learning, and enhance instructional efficiency in universities (Babo, Azevedo & Almeida, 2022).Technology-based assessment in the management of instructional practices is an advanced form of digital assessment that not only evaluates students' learning outcomes but also improves instructional delivery through interactive feedback systems, data analytics, adaptive testing, collaborative learning tools, and real-time monitoring of students' academic progress.

Instructional practices in this study are the methods, strategies, and activities lecturers use to facilitate teaching and learning, including lesson delivery, classroom management, student engagement, assessment, feedback, and instructional supervision. Iloh and Ogogor (2022) noted that sustainable management of instructional practices refers to effective planning, organization, implementation, monitoring, and continuous improvement of teaching and learning activities to enhance long-term educational quality and efficiency. It emphasizes continuity, digital integration, and quality assurance in instructional delivery in response to changing societal and technological demands. In university education, it includes classroom management, student engagement, digital learning integration, continuous assessment, instructional supervision, and academic record management, with sustainability increasingly advocated in curriculum design and delivery (Nwankwo, 2014).

The integration of Technology-Based Assessment (TBA) for sustainable management of instructional practices in universities has become increasingly important due to challenges such as large class sizes, student overpopulation, rising enrolment, and the growing demand for flexible and distance learning. Iloh and Ogogor (2022) noted that these realities require efficient academic management systems, with lecturers in public universities playing a central role in adopting technology-based assessment practices. Lecturers are expected to design digital assessments, use Learning Management Systems (LMS), manage online platforms, provide electronic feedback, and monitor students' academic activities effectively. Common tools include Computer-Based Testing (CBT), online quizzes, virtual classrooms, digital assignment systems, plagiarism detection tools, and automated grading systems. The successful integration of TBA depends largely on lecturers' digital literacy, technological competence, attitudes toward technology, and willingness to adopt innovative assessment methods (Scherer, Siddiq & Tondeur, 2021).

Despite the benefits of educational technologies, many lecturers still rely on traditional assessment methods such as written examinations, manual grading, and face-to-face project supervision. This reliance may limit the quality, flexibility, and sustainability of instructional management in universities. Therefore, greater integration of technology-based assessment is necessary to

improve instructional effectiveness and promote sustainable educational practices. Studies have highlighted factors such as inadequate technological infrastructure, poor internet connectivity, unstable electricity supply, insufficient digital competencies, lack of institutional support, inadequate funding, resistance to technological change, and limited professional development opportunities as hindrances to effective technology integration among lecturers (Adarkwah, 2021; Okoye & Nwankwo, 2024).

There is still uncertainty regarding the various TBA utilized by lecturers in managing instructional practices, coupled with the extent to which lecturers in public universities in Anambra State integrate TBAfor sustainable management of instructional practices. Studies have been conducted in the areas of digital technologies, ICT utilization, e-learning adoption, digital teaching strategies and online learning systems in higher education (Afolabi, 2022; Akinsolu & Fadokun, 2022; Eze, Chinedu-Eze& Bello, 2021; Yusuf & Balogun, 2021). However, limited scholarly attention has been paid to TBA tools utilized by lecturers, the extent of lecturers' integration of TBA and the relevance of TBA to sustainable instructional management. Based on this, the study sought to examine lecturers' integration of Technology-Based Assessment for sustainable management of instructional practices in public universities in Anambra State.

Statement of the Problem

The rapid advancement of digital technologies has made Technology-Based Assessment (TBA) an important component of instructional management in higher education. Through tools such as computer-based tests, Learning Management Systems, online quizzes, electronic assignments, automated grading systems, and online feedback platforms, TBA is expected to enhance instructional effectiveness and sustainable management of teaching and learning. Despite these benefits and the increasing demand for digitalized instructional practices in universities, observations indicate that many lecturers in public universities still rely heavily on conventional assessment methods. Although various TBA tools are available for instructional management, it is unclear which of these tools are utilized by lecturers in public universities, particularly in Anambra State, and the extent to which they are integrated into instructional practices. This uncertainty raises concerns about the level of digital transformation and the sustainability of instructional management in these universities.

Furthermore, inadequate integration of TBA may undermine effective instructional delivery, students' engagement, feedback processes, and academic accountability. The situation may be associated with lecturers' perceptions of the relevance of TBA and challenges such as inadequate technological infrastructure, poor internet connectivity, unstable power supply, and limited opportunities for professional development. While TBA has been widely recognized as a means of improving instructional management, there is limited empirical evidence on the technology-based assessment tools utilized by lecturers, the extent of their integration, and the challenges affecting their use in public universities in Anambra State. It is this gap in knowledge and practice that necessitated the present study on lecturers' integration of Technology-Based Assessment for sustainable management of instructional practices in public universities in Anambra State.

Purpose of the Study

The purpose of this study was to examine lecturers' integration of Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria. Specifically, the study sought to:

1. identify the various Technology-Based Assessment (TBA) tools utilized by lecturers for sustainable management of instructional practices in public universities in Anambra State, Nigeria;

2. determine the extent to which lecturers integrate Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria;
3. examine the relevance of integrating technology-based assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria; and
4. ascertain the constraints to lecturers' effective integration of Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria.

Research Questions

The following research questions guided the study:

1. What are the various Technology-Based Assessment (TBA) tools utilized by lecturers for sustainable management of instructional practices in public universities in Anambra State, Nigeria?
2. To what extent do lecturers integrate Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria?
3. What is the relevance of integrating technology-based assessment (TBA) for the sustainable management of instructional practices in public universities in Anambra State, Nigeria?
4. What constraints hinder lecturers' effective integration of Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria?

Methods

The study adopted descriptive survey research design. The population of the study comprised 3,247 lecturers in the two public universities in Anambra State. A sample of 974 lecturers was selected from the population using a multistage sampling procedure.

The instrument used for data collection was researchers structured questionnaire titled: "Lecturers' Integration of Technology-Based Assessment for Management of Sustainable Instructional Practices Questionnaire (LITBAMSIPQ)". The questionnaire was also structured on a 4-point rating scale of Strongly Agree (SA) - 4 points, Agree (A) - 3 points, Disagree (D) - 2 points and Strongly Disagree (SD) -1 point to answer research questions 1, 3 and 4, while a 4-point rating scale of Very High Extent (VHE) - 4 points, High Extent (HE) -3 points, Low Extent (LE) - 2 points, and Very Low Extent (VLE) -1 point, was used to answer research question 2. The instrument was subjected to face and content validation by three experts from the Departments of Educational Management and Policy and Measurement and Evaluation. All from the Faculty of Education, Nnamdi Azikiwe University, Awka. The reliability coefficient values of 0.81, 0.85, 0.87, and 0.82 were obtained respectively for the four clusters and were added up to give an overall internal consistency value of 0.84, which was considered adequate for the study. A total of 974 copies of the questionnaire were distributed to the respondents, and only 961 copies were retrieved, which gave 98.7% rate of return. The data collated were analyzed using mean and standard deviation. The decision rule for interpreting the questionnaire items was based on a criterion mean of 2.50. Any item with a mean score of 2.50 or above was considered in support of the statement and was therefore interpreted as Agree **or** High Extent**,** as applicable. Any item with a mean score below 2.50 was considered not to be in support of the statement and was therefore interpreted as Disagree **or** Low Extent, as applicable.

Results

Research Question 1: What are the various Technology-Based Assessment (TBA) tools utilized by lecturers for sustainable management of instructional practices in public universities in Anambra State, Nigeria?

Table 1: Mean and SD Scores of Lecturers on the various TBA tools utilized by lecturers for sustainable management of instructional practices in Public Universities in Anambra State, Nigeria

N = 961 Lecturers

S/N	Please share your opinion concerning using the under-listed TBA tools for the sustainable management of instructional practices	SA	A	D	SD	X	SD	Decision
1.	Computer-Based Tests (CBT) are utilized for students' assessment	204	376	194	187	2.62	1.02	**Agree**
2.	Google Forms are used for conducting quizzes and examinations	182	397	209	173	2.61	0.99	**Agree**
3.	Learning Management Systems (LMS) such as Google Classroom are utilized for instructional management, as well as students' assessments	208	402	186	165	2.68	1.00	**Agree**
4.	Online/electronic assignment submission platforms like Moodle are used for continuous assessment	159	214	391	197	2.35	0.98	**Disagree**
5.	I utilize video conferencing tools such as Zoom or Microsoft Teams for online instructional or virtual assessment activities	179	367	223	192	2.55	1.01	**Agree**
6.	Electronic portfolios (e-portfolios) are used for monitoring students' academic progress	106	195	432	228	2.19	0.92	**Disagree**
7.	Online discussion forums/interactive educational applications are utilized as part of students' assessment processes and classroom assessment activities	113	169	390	289	2.11	0.97	**Disagree**
8.	Plagiarism detection software such as Turnitin is used for academic assessment, including evaluating students' assignments	186	374	217	184	2.58	1.01	**Agree**
9.	I utilize Kahoot, Quizizz, or similar digital quiz applications for classroom assessments	105	127	382	347	1.99	0.96	**Disagree**
10.	Automated or digital grading systems for managing students' assessment records, including result processing, such as Canvas, Google Classroom Grading System	93	101	476	291	2.00	0.89	**Disagree**
Overall Mean Score & SD =						**2.37**	**1.01**	**Disagree**

Analysis of data in Table 1 revealed that only items from 1-3, 5, and 8 were rated above 2.50 of the acceptable mean score by the university's lecturers to show their agreement with these statements. Items 4, 6-7, and 9-10 were rated below 2.50 of the acceptable mean score by the university's lecturers to show their disagreement with the statements. The overall mean score and standard deviation (SD) of 2.37 and 1.01 indicated closeness in the mean responses of the lecturers. This result indicated that the various Technology-Based Assessment (TBA) tools were less utilized by lecturers for sustainable management of instructional practices in public universities in Anambra State, Nigeria.

Research Question 2: To what extent do lecturers integrate Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria?

Table 2: Mean and SD Scores of Lecturers on the Extent to which they Integrate TBA for Sustainable Management of Instructional Practices in Public Universities in Anambra State

N = 961 Lecturers

S/N	Please share your opinion concerning the extent to which you integrate TBA for the sustainable management of instructional practices.	VHE	HE	LE	VLE	X	SD	Decision
	Extent of your integration of:							
11.	technology-based assessment, such as Google Classroom, Moodle, and online quizzes, into instructional practices	153	204	408	196	2.33	0.97	**Low Extent**
12.	online tests and quizzes for students, like Kahoot, CBT, and Google Forms tests	176	245	371	169	2.45	0.98	**Low Extent**
13.	digital platforms for grading and feedback delivery, such as Moodle, Google Classroom, and LMS portals	128	199	394	240	2.22	0.97	**Low Extent**
14.	technology-based assessment into both formative and summative evaluations, such as online project presentations via Zoom or Teams, Blackboard assessment tools, and CBT exams	159	200	327	275	2.25	1.05	**Low Extent**
15.	both traditional and digital assessment methods during instruction, such as blending paper assignments with e-submissions	168	187	262	344	2.19	1.10	**Low Extent**
16.	technology-based assessment tools, such as e-portfolios, to monitor students' academic progress	147	194	329	291	2.20	1.04	**Low Extent**
17.	online collaborative assessment activities into classroom instruction, such as group projects on Google Docs	181	252	336	192	2.44	1.01	**Low Extent**
18.	digital assessment tools during instructional delivery, such as Socrative quizzes, live online polls	136	217	355	253	2.25	1.00	**Low Extent**
19.	technology-based assessment in large classroom management, such as automated grading systems, online attendance, and CBT	167	173	333	288	2.23	1.06	**Low Extent**
20.	online assessment activities such as digital quizzes, assigning collaborative online projects	155	201	349	256	2.27	1.02	**Low Extent**
Overall Mean Score & SD =						**2.28**	**1.02**	**Low Extent**

Analysis of data in Table 2 revealed that none of the items from 11-20 were rated above 2.50 of the acceptable mean score by the university's lecturers to show their agreement with any of these statements. Regardless, all the items were rated below 2.50 of the acceptable mean score by the university's lecturers to show their disagreement with the statements. The overall mean score and standard deviation (SD) of 2.28 and 1.02 indicated closeness in the mean responses of the lecturers. This result indicated that the extent to which the lecturers integrated Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria, was to a low extent.

Research Question 3: What is the relevance of integrating technology-based assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria?

Table 3: Mean and SD Scores of Lecturers on the Relevance of Integrating TBA for Sustainable Management of Instructional Practices in Public Universities in Anambra State

N = 961 Lecturers

S/N	Please share your opinion concerning the relevance of integrating TBA for the sustainable management of instructional practices	SA	A	D	SD	X	SD	Decision
	This includes the Technology-Based Assessment:							
21.	enhances lesson evaluation accuracy, which improves instructional effectiveness	388	393	101	79	3.13	0.91	**Agree**
22.	encourages active participation through quizzes, which improve students' academic engagement	375	444	62	80	3.16	0.87	**Agree**
23.	promotes timely feedback to students through instant scoring of online quizzes, including immediate correction of CBT tests, and quick online comments on assignments	327	484	83	67	3.11	0.83	**Agree**
24.	improves accuracy in grading and record keeping	356	467	65	73	3.15	0.85	**Agree**
25.	supports flexible learning and instructional continuity	225	454	194	88	2.85	0.88	**Agree**
26.	simplifies students' attendance monitoring, which enhances classroom management efficiency	324	379	97	161	2.90	1.05	**Agree**
27.	reduces examination malpractice, such as using plagiarism detection software or timed online examinations	264	449	155	93	2.92	0.90	**Agree**
28.	promotes learner-centered instructional practices through self-paced learning and personalized feedback	361	469	72	59	3.18	0.82	**Agree**
29.	improves lecturers' productivity in instructional management by simplifying assessment administration, likewise, improving the efficient management of students' results.	313	482	89	77	3.07	0.86	**Agree**
30.	contributes to sustainable educational development in universities, which supports long-term instructional innovation, digital transformation in education, and enhances quality assurance practices	258	357	251	95	2.81	0.94	**Agree**
Overall Mean Score & SD =						**3.03**	**0.90**	**Agree**

Analysis of data in Table 3 revealed that all the items from 21-30 were rated above 2.50 of the acceptable mean score by the university's lecturers to show their agreement with any of these statements. None of these items was rated below 2.50 of the acceptable mean score by the university's lecturers to show their disagreement with the statements. The overall mean score and standard deviation (SD) of 3.03 and 0.90 indicated closeness in the mean responses of the lecturers. This result indicated the relevance of integrating technology-based assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria.

Research Question 4: What constraints hinder lecturers' effective integration of Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria?

Table 4: Mean and SD Scores of Lecturers on the Constraints to Effective Integration of TBA for Sustainable Management of Instructional Practices in Public Universities in Anambra State

N = 961 Lecturers

S/N	Please share your opinion concerning the constraints to effective integration of TBA for the sustainable management of instructional practices. This includes:	SA	A	D	SD	X	SD	Decision
31.	Inadequate/insufficient ICT infrastructure, such as computer laboratories, digital devices, and functional digital learning centres	393	484	45	39	3.28	0.73	**Agree**
32.	Poor internet connectivity	385	430	52	94	3.15	0.91	**Agree**
33.	Unstable electricity supply	423	401	66	71	3.22	0.87	**Agree**
34.	Lack of adequate training in the use of technology-based assessment	339	437	98	87	3.07	0.90	**Agree**
35.	Limited digital competencies/proficiencies among lecturers and students	340	467	101	53	3.14	0.81	**Agree**
36.	Inadequate institutional support	359	479	79	44	3.20	0.77	**Agree**
37.	Insufficient funding for the university	417	421	68	55	3.25	0.82	**Agree**
38.	Resistance to technological change affecting the use of digital assessment tools	121	187	389	264	2.17	0.97	**Disagree**
39.	Large class sizes, including student overpopulation	388	411	77	85	3.15	0.90	**Agree**
40.	Lack of adequate technological facilities, such as projectors and smart boards	403	425	82	51	3.23	0.82	**Agree**
Overall Mean Score & SD =						**3.09**	**0.91**	**Agree**

Analysis of data in Table 4 revealed that only one item from 38 was rated above 2.50 of the acceptable mean score by the university's lecturers to show their agreement with these statements. All the other items, 31-37 and 39-40, were rated below 2.50 of the acceptable mean score by the university's lecturers to show their disagreement with the statements. The overall mean score and standard deviation (SD) of 3.09 and 0.91 indicated closeness in the mean responses of the lecturers. This result indicated the constraints to lecturers' effective integration of Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria.

Discussion

The findings revealed that Technology-Based Assessment (TBA) tools were generally underutilized by lecturers for the sustainable management of instructional practices in public universities in Anambra State. Only a few tools, such as Computer-Based Tests (CBT), Google Forms, Learning Management Systems (e.g., Google Classroom), Zoom, Microsoft Teams, and Turnitin, were utilized. This finding is consistent with Adarkwah (2021), who reported increased adoption of technologies such as Google Classroom, Zoom, and online testing platforms for instructional continuity in higher education. Similarly, Babo, Azevedo, and Almeida (2022) found that digital assessment platforms, including LMS and online assessment systems, were gradually being integrated into university instructional practices. The finding also agrees with Okoye and Nwankwo (2024), who observed that although lecturers utilized selected technology-enhanced assessment tools, the level of utilization remained low due to infrastructural challenges. However, several TBA tools, including Moodle-based assignment platforms, e-portfolios, online discussion forums, interactive assessment applications, Kahoot, Quizizz, and automated grading systems, were not utilized. This suggests that public universities in Anambra State may not fully realize the benefits of sustainable instructional management and quality educational delivery if the low utilization of technology-based assessment persists. The finding supports Yusuf and Balogun

(2021), who reported that inadequate technological facilities and weak institutional support limited lecturers' use of ICT for instructional delivery and assessment. It also aligns with Okoye and Nwankwo (2024), who found that infrastructural limitations and inadequate technological competencies contributed to lecturers' continued reliance on traditional assessment methods.

The study further revealed that lecturers integrated Technology-Based Assessment (TBA) for the sustainable management of instructional practices in public universities in Anambra State to a low extent. This indicates that digital assessment tools were not regularly or effectively incorporated into teaching, assessment, grading, feedback delivery, and instructional management processes. The finding suggests that achieving sustainable instructional management may remain challenging unless lecturers increase the integration of technology-based assessment into teaching and learning activities. Specifically, tools and practices such as Learning Management Systems, online quizzes and tests, digital grading and feedback platforms, online presentations, collaborative assessment activities, automated grading systems, and other digital assessment applications were integrated only to a low extent. The finding is consistent with the findings of Eze et al. (2021) study, which revealed that lecturers in many Nigerian universities integrated e-learning and digital assessment technologies only to a low or moderate extent. The study identified inadequate ICT competencies and infrastructural challenges as major factors limiting effective integration. The finding also aligns with Teo's (2011) study, which confirmed that lecturers' attitudes toward technology and technological self-efficacy significantly influenced the extent of educational technology integration. Lecturers who possess limited confidence in digital technologies often demonstrate low integration levels. Afolabi's (2022) study also found that poor internet accessibility and high cost of data subscriptions limited lecturers' integration of digital instructional and assessment technologies in Nigerian universities. The study emphasized that inconsistent internet connectivity negatively affected sustainable instructional practices.

The findings revealed that Technology-Based Assessment (TBA) is highly relevant for the sustainable management of instructional practices in public universities in Anambra State, Nigeria. Its relevance is reflected in its ability to improve assessment accuracy and instructional effectiveness, enhance students' engagement through online quizzes and interactive assessments, and provide timely feedback through automated scoring, CBT systems, and instant online comments. TBA also improves grading accuracy and record management, supports flexible and continuous learning, strengthens classroom management through improved attendance tracking, and reduces examination malpractice through tools such as plagiarism detection software and timed online assessments. In addition, it promotes learner-centered instruction through self-paced learning and individualized feedback, enhances lecturers' productivity by simplifying assessment processes, and contributes to sustainable educational development through digital transformation and quality assurance in universities. This finding is consistent with Redecker and Johannessen (2013), who reported that technology-enhanced assessment improves teaching quality, assessment reliability, student participation, and instructional efficiency in higher education. It also aligns with the OECD (2021), which emphasized that digital assessment technologies support learner-centered instruction, personalized learning, and sustainable educational development. Similarly, Babo et al. (2022) found that technology-enhanced assessment contributes to flexibility in teaching and learning, improved feedback delivery, increased student motivation, and strengthened quality assurance in higher education.

The findings identified a number of constraints to lecturers' effective integration of Technology-Based Assessment (TBA) for sustainable management of instructional practices in public universities in Anambra State, Nigeria. These include inadequate ICT infrastructure, such as functional computer laboratories, digital devices, and learning centres, as well as poor internet

connectivity and unstable electricity supply. Other constraints are insufficient training in technology-based assessment, limited digital competencies among lecturers and students, inadequate institutional support, poor funding, large class sizes, and a shortage of technological facilities such as projectors and smart boards. However, resistance to technological change was not identified as a constraint, as lecturers demonstrated willingness to adopt digital assessment tools. This finding suggests that without addressing these infrastructural, financial, and capacity-related challenges, effective integration of Technology-Based Assessment for sustainable instructional management may remain limited in Nigerian public universities. The finding agreed with the findings of Yusuf and Balogun (2021) study, which discovered that inadequate ICT infrastructure and unstable electricity supply were major constraints affecting ICT integration in Nigerian higher education institutions. The universities lacked adequate technological resources necessary for effective digital instructional management. Similarly, Afolabi (2022) study identified poor internet accessibility and high cost of internet services as major barriers to effective technology-enhanced learning and assessment in Nigerian universities. Both lecturers and students struggled with unstable internet networks and expensive data subscriptions during online instructional activities. The finding is consistent with the findings of Adarkwah (2021) study, which also discovered that poor internet connectivity, inadequate technological infrastructure, and limited digital competencies were major barriers to educational technology integration in higher institutions.

Conclusion

This study concludes that lecturers' integration of Technology-Based Assessment (TBA) for sustainable instructional management in public universities in Nigeria is relatively low, despite its high relevance for improving teaching effectiveness, student engagement, feedback, grading, and sustainable educational development. This low integration is constrained by challenges such as inadequate ICT infrastructure, poor internet connectivity, and insufficient funding, making it necessary for universities to strengthen support systems and promote wider adoption of TBA.

Recommendations

Based on the findings, the following recommendations were made:

1. University management, with the help of the government, should provide adequate funding and ICT infrastructure (reliable internet, computer labs, digital platforms, and stable electricity) to support lecturers' effective use of Technology-Based Assessment (TBA) tools for sustainable instructional management in universities.
2. Public university management, with support from the National Universities Commission (NUC) and TETFund, should organize regular workshops, seminars, and training programmes to enhance lecturers' digital literacy and competencies for effective and sustained adoption of Technology-Based Assessment (TBA) in instructional management.
3. Public university management and institutional leaders (including Deans and Heads of Departments) should provide capacity-building programmes and seminars to enhance lecturers' understanding of the relevance of Technology-Based Assessment (TBA) and encourage its effective use in sustainable instructional management.
4. Education stakeholders (Federal and State governments, NUC, university management, private sector, and NGOs) should address the identified challenges by providing adequate funding, supportive ICT policies, clear institutional guidelines, continuous capacity-building, and improved ICT infrastructure to enhance the effective adoption and sustainability of Technology-Based Assessment (TBA) in universities.

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IMPERATIVES OF INNOVATION IN TEACHING AND LEARNING OF ENGLISH LANGUAGE IN NIGERIAN SECONDARY SCHOOLS

Adebimpe Olubunmi ADEBANJO, PhD
Department of Early Childhood and Primary Education
Emmanuel Alayande University of Education, Oyo, Oyo State, Nigeria
adebanjoao@eauedoyo.edu.ng

Abstract
The English language is accorded a significant position among all school subjects, and indeed in all facets. It is viewed as a second language, a language of instruction in the classroom settings as well as a medium of communication during official meetings. Being a core subject at the junior and the senior secondary schools, students are expected to pass the subject at credit-level in examinations conducted by West African Examinations Council (WAEC) or National Examinations Council (NECO) before gaining admission to any higher institution of learning. Students' performance in English Language is consistently considered unsatisfactory on yearly basis. As evidenced, the recently released WAEC results revealed that 38.32 percent of senior secondary school students in Nigeria passed English Language at credit-level. Many researchers had worked on the possible factors that could be responsible for the poor performance by focusing on teaching strategies, students-related factors, teachers-related factors, home-related factors and school-related factors, and professed solutions by giving necessary recommendations; despite this, the problem still persists. In order to contribute to the frontiers of knowledge, the paper explored the significant roles of innovation in teaching/learning of English Language at secondary school level in Nigeria. Innovation is the process of introducing new ideas that are effective and productive in teaching/learning activities in order to improve the conventional ways of teaching. It is hoped that when innovation is incorporated in the teaching/learning of English Language, there would be an improvement in the academic performance of students in that particular subject and all other subjects in general.

Keywords: Innovation, teaching/learning, innovative techniques, English Language

Introduction

Nigeria is multicultural, multilingual and multiethnic in nature with over five hundred indigenous languages and over three hundred ethnic groups. The country sees the English language as the main official language in all contexts— be it education, governance, law courts, media, business and commerce, and external affairs. The major characteristic of English language is the prestigious position it occupies over all other Nigerian major languages: Hausa, Igbo and Yoruba. English language appears to be the most spoken in the world; by implication, it connects Nigeria to the global world.

In Nigeria's educational sector, English language is the medium of instruction from primary to higher institutions of learning. At the primary and secondary school levels, it is a core subject which every student is expected to offer and pass. It determines the successes of students because a deficiency in it affects the general performance of students, be it in arts, commercial or sciences. For a student to gain admission into any higher institution of learning, he/she must have a credit-pass in English Language in the external examinations that are usually organised by West African Examinations Council (WAEC) or National Examinations Council (NECO). Despite the fact that English Language is being used as a medium of instruction as well as taught as a core subject from primary school, many students seem to be deficient in it. The WAEC examination

result in English Language is confirmed to be unsatisfactory on yearly basis. This is evidenced in the just released WAEC results which revealed that 38.32 percent of the students passed English Language at credit-level. It indicates that just a few number of the students can gain admission into any higher institution of learning this session, be it colleges of education, polytechnics, school of nursing or universities because a credit pass in English Language is one of the major conditions for admissions.

The yearly occurrence of mass failure in English Language in external examinations has been giving stakeholders great concern. Thus, many scholars had worked on the factors that might have contributed to the failure rate and suggested solutions, but the problem is yet to be solved. Adeyemo and Babajide (2020) identified the family background; Olatunji and Adeyemi (2018): parents involvement; Ogunsiji and Daramola (2022): pedagogical factors; Uwaifo and Uwaifo (2019): teacher-centred mode of teaching instead of student-centred; Afolabi and Adesina (2020): environmental factors; Agboghoroma and Oghuvbu (2018): curriculum inadequacy; Ibe and Maduewe (2017): students motivation and attitude; Bamidele and Ayeni (2023): language deficiency of the students and Abang and Ekong (2019): learning disabilities. All these scholars have contributed to the pool of knowledge in one way or the other, but little attention is being given to the concept 'innovation'.

Innovation as a Concept

Innovation has to do with creation of values in new ways. It is part of day-today activities and it plays a pivot role in improving students learning outcomes as well as enhances teachers' effectiveness in teaching. Innovation could be viewed as a process in which creative ideas are brought into implementation in order to improve the conventional ways of teaching. The innovative educational practices of a teacher involve promoting active and personalised learning where students are encouraged to take responsibility for their own learning. These practices allow students to explore information in various ways and contexts, engage in cooperative learning through intelligent project, and restructure the classroom organisation to enhance social cohesion through student interactions (Ellie, 2022). An innovative English Language teacher generates unique ideas that would benefit several stakeholders, including the students, the teacher's colleagues and the whole institution. Innovation is most effectively achieved via the development of a tool, a tangible advantage, or a kind of assistance that addresses a problem or provides a benefit (Olakunde, 2023). In the absence of a creative English Language teacher, innovative teaching cannot occur. This is because only an innovative teacher has the ability of effectively organising and addressing difficulties rather than pondering on them (Ellis, 2019).

Innovative activities employed in the classroom have the potential to transform the way in which students acquire knowledge and how they may effectively apply it in practical situations. The skills and the confidence gained by students throughout their school years significantly influence their approach to future employment since the classroom serves as the foundation for future prospect. Therefore, English Language teachers should encourage activities that include open-ended questions, collaborative and creative projects, brainstorming sessions and conversations, even in the midst of demanding curricular schedules. Students do exhibit enhanced innovative skills beyond the confines of the classroom. They redefine challenges and opportunities, leading to practical and innovative solutions in the long run (Ukoima, Miina and Dimkpa, 2021).

The optimal combination of creativity and curriculum enables students to incorporate innovation in acquiring new knowledge. Creativity is one's ability to think outside the box while the curriculum acts as the guiding path. By implication, curriculum has to be structured to align with new ideas. According to Sri and Novianty (2025) there are five distinctive features that could influence the adoption of innovation: relative advantage, compatibility, complexity, triability and

observability. Relative advantage focuses on the benefit to be derived in the new idea when compared with the existing ones; compatibility deals with the alignment of the new idea with the existing curriculum, practices and students' needs; complexity is the evaluation of the difficulty level of the idea; triability allows for the proper testing of the idea to determine its effectiveness/suitability before the general acceptability, and observability refers to the visibility level among teachers, students and other stakeholders. An innovative English Language teacher should be able to apply the 5Es of teaching, which are engage, explore, explain, elaborate and evaluate, for effective teaching and learning accomplishment. He/she should encourage collaborative learning, thinking outside the box for new ideas, vividly discussing the concept needed to be taught, expatiating by building on the students' prior knowledge and periodically assessing the students to determine their comprehension level.

Innovative Methods that can be Applied in Teaching and Learning of English Language

Employing innovative idea in classroom activities is crucial for a teacher's success in his/her profession because it propels a teacher's creations and development. Acquiring innovative skills is not optional for English Language teachers to be relevant in the 21st century because we are in the world of technological advancement. Kirsten (2023) stated five innovations that could effectively change the teaching and learning of English language. They are the use of authentic materials with natural language to enhance proper communication; the use of interactive white board where the teacher can save and reuse work for references, replay the listening activities which had been previously recorded as well as access the internet for necessary information; use of digital tools such as Google docs to share information on the platforms; online continuous professional development by accessing information online and sharing with other teachers for collaboration to take place; and the last but not the least is dogma which is an approach that is student-centred.

This indicates that an innovative English Language teacher should be able to apply the 5Cs of teaching: collaboration, communication, creativity, critical thinking and computational skill effectively. This implies that English Language teachers should work hand in hand with their students and their colleagues that are in the same area of specialisation. Thus, communication is very important because when there is proper interaction, there would be exchange of ideas/opinions which invariably enhance effective teaching and learning, but if there is communication gap, interaction level would be poor; thus, contributing to unsatisfactory performance. Critical thinking skills could be deductive, analytical, interpretative, synthetic, and evaluative. Deductive skill emphasises making logical inferences; analytical is ability to break down problems or ideas into smaller components to enhance understanding; interpretative refers to one's ability to give detailed account of a particular concept; synthetic has to do with the ways ideas are combined to form a cogent conclusion, while evaluative thinking involves making objective judgments about issues or ideas. English Language teachers should know when and how to make use of different skills; the skill to be applied depend on the students intelligence level taking into consideration the individual differences as well as the level of difficult of the concept to be taught. Also, English Language teachers should move with the trend of things by upgrading their knowledge in technological tools applications.

Likewise, NMREC Achievers (2024) highlighted some innovative techniques that can be applied in English language classrooms; they include the use of think-pair-share technique which encourages collaborative learning, students actively participate and exchange ideas thereby enhance proper understanding of the concepts being taught; role-playing: students are allowed to mimic a particular subject/object in real life situations; SMART Board teaching, that is, the use of white board for teaching; introduction of brainstorming activities to enhance the critical

thinking abilities of the students as a means of generating a number of ideas to a specific problem; E-bridge activity that comprises the technology-based activity needed to bridge the gaps between learning and understanding; for instance, using software-based models to emulate the functionality of physical hardware; class polls can be used as feedback from the students responses; chart preparation/presentation could be done through provision of visual aids, such as diagrams, posters or graphs to illustrate the concepts being discussed; usage of LMS to create opportunities for administering online quizzes, examinations and assignments for students; likewise, students could submit their responses electronically while feedback and grades could be sent through the platform; flipped classroom could be encouraged by the teacher, teaching/learning could take place outside the classroom using videos or online resources while class time would be used for discussion and application of knowledge.

The teacher needs to apply the 5Ts of teaching effectively: time of task, teacher preparedness, textbook (resources), technology and testing at the right level. English Language as a subject has different aspects: oral, lexis and structure, comprehension, summary and essay writing. Each of these aspects should be taught thoroughly without leaving any untouched. It is the duty of English Language teacher to appropriately distribute the allotted time for the subject based on the aspects to be focused, identify the productivity level as well as areas of difficulties. Although it might be difficult for teachers of English to shift ground from the conventional way of teaching, it should be realised that changes is inevitable. English Language teachers should be versatile in subject mastery as well as skills to be applied for effective teaching. Textbook should be selected to match students' level of intelligence taking into consideration their age as well as their background knowledge. English Language teachers should test the students at intervals to determine their comprehension level. The assessment could be formative or summative. It is formative when students are tested at the beginning of the classroom activities to be sure of their background knowledge, that is, their prior experiences on the concepts of discussion. On the other hand, the summative assessment occurs at the end of the lesson. Through students' responses, the English Language teacher would know where the students are lagging behind and try as much as possible to explain further.

Chong (2024) enumerated ten trends and innovations in English language teaching; they are global citizenship and students as agents of change, inquiry-based learning and critical thinking, self-awareness and emotional intelligence, interpersonal skills, global competitiveness, learner autonomy, the importance of real-world situations, speaking practice with speech recognition, artificial intelligence and embracing diversity, and collaboration skills. Dyshkant (2026) went further to state twenty (20) innovative teaching methods which could enhance effective teaching/learning, and these are interactive lesson, using virtual reality technology, using AI in education, blended learning , 3D printing also known as additive manufacturing which involves creating objects based on digital model, use of design-thinking process, project-based learning, jigsaw cloud computing teaching, flipped classroom, peer teaching, peer feedback, crossover teaching, personalized learning, active learning, gamification, problem-based learning, mistake-led teaching and collaborative learning. According to Joy et al. (2023), flipped classroom was used in Chennai to present to the students the anatomy of larynx using various types of model. The participants agreed that learning was made easier for them because they were already been exposed to the concept before the presentation. Lombardo et al (2021) also supported the fact that incorporating innovative techniques in teaching/learning enhances improvement in learning outcomes. In this era of technological advancement, English language teachers should be ready to move with the trend of things by familiarising themselves with the changes that are taking place in the educational setting because they can only impact the knowledge they have acquired.

Also, Care College of Engineering (2026) viewed innovation in teaching and learning as a process that involves incorporation of technological tools and resources, such as PowerPoint presentation, online quiz, webinar, video lectures, online competition, workshops, lecture method and interactive learning, application based learning, practical learning, industrial projects, activity based learning, experimental learning, problem-solving session, the minutes paper activity, brainstorming and group activity. This implies that for teachers of English language to be relevant in the 21st century they have to be computer literate.

Siumariata (2024) explored different types of innovative techniques, and made a submission that although innovation enhances effective teaching/learning, but there are some challenges being faced when it comes to complementing innovative ideas with conventional/traditional teaching methods. Those challenges include novice in the application of digital tools, poor accessibility to internet services and over-dependence on digital tools. It implies that both students and teachers should brace-up and try as much as possible to boost their knowledge on computer applications; stakeholders should be supportive by providing condusive environment for teaching/learning. Also, teachers should be mindful not to over-use digital tools because the tools cannot replace the functions of teachers. Teachers should always be on ground to act as instructors.

Hafidurranman and Dwiaryanti (2024) stated some advantages of using technology-based tools to teach and they are as follows: enhancing students' language proficiency which invariably boost the learning outcomes, developing critical thinking abilities in the students and facilitating proper interaction between students as well as their teachers. Accordingly, it was suggested that teachers should equip themselves with adequate skills by undergoing trainings, workshops and seminars, realising the fact that knowledge is not static. Likewise, Nuri (2025) examined the impact of innovative strategies in English language teaching. It was revealed that the strategies positively influence students' language competency and proficiency. It was then recommended that stakeholders should implement innovative techniques to improve learning experiences of students.

Conclusion

It has been observed that there has been a shift from theoretical practices (teacher-centred) in the classroom activities to practicalilty (student-centred) through the application of technological tools. The usefulness of innovative techniques cannot be underrated in this industrial revolution age in order to attain this height. It is believed that when teachers of English Language incorporate innovation into their teaching, students would understand the contents being taught better, respond accordingly, retain the information received and apply the knowledge gained into their day-to-day activities when need be.

Recommendations

It is then recommended that:

- English Language teachers should always incorporate innovative techniques into their teaching for effectiveness to take place;
- Both English Language teachers and students should update their knowledge on the use of technological tools to enhance English Language performance in schools;
- Stakeholders should make classrooms conducive to learning by providing necessary infrastructure, such as uninterrupted internet facilities;
- Secondary school curriculum should be periodically reviewed to include those innovative techniques that can be used in teaching English Language as a school subject; and
- English Language teachers should be encouraged to go for trainings, workshops and seminars on how to apply innovations in teaching/learning.

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FIFTEEN YEARS ON: ASSESSING THE INTEGRATION OF LEADERSHIP FOR LEARNING PRACTICES IN GHANAIAN BASIC SCHOOLS

Theophilus Kwasi Odame Danso
Institute for Educational Planning and Administration,
University of Cape Coast
theophilus.danso@ucc.edu.gh

Abstract
The Leadership for Learning (LfL) framework, which links leadership directly with teaching and learning processes, was introduced in Ghana in 2009 through a partnership between the Ghana Education Service, the University of Cape Coast, and the University of Cambridge. Fifteen years after its initial implementation, this mixed-methods study assesses the extent to which LfL practices have been integrated into basic schools in Ghana's Central Region. Using a convergent parallel design, quantitative data were collected from 525 head teachers across seven districts through structured questionnaires. In comparison, qualitative insights were gathered from 10 purposively selected head teachers through semi-structured interviews. The findings reveal that several key LfL practices have been successfully integrated, including promoting continuous professional development for teachers (M=4.5), maintaining open communication between head teachers and staff (M=4.6), and fostering transparent communication with parents and communities (M=4.5). Head teachers reported positive outcomes, including enhanced teacher instructional performance (M=4.3), improved learner engagement (M=4.3), and safer school climates (M=4.4). However, significant challenges persist, particularly in resource mobilisation (M=3.2), equitable resource distribution (M=3.6), and community involvement (M=3.8). The study concludes that while head teachers have successfully embedded learner-centred and collaborative leadership approaches, systemic barriers including inadequate infrastructure (M=4.5), limited funding (M=4.3), and frequent policy changes (M=4.3) continue to constrain full LfL implementation. The findings contribute to understanding how LfL principles are adapted and sustained in resource-constrained, sub-Saharan African contexts and have implications for leadership development programmes, education policy, and international development partnerships.

Keywords: Leadership for Learning; basic schools; programme evaluation; Ghana; educational leadership

Introduction

Education is widely recognised as essential for societal development and individual empowerment (UNESCO, 2021), with research demonstrating that school leadership is a key determinant of student success, second only to classroom instruction (Leithwood, Louis, Anderson & Wahlstrom, 2004). This recognition has led to the growing prominence of frameworks such as Leadership for Learning (LfL), which link leadership directly to teaching and learning processes, promote collaborative school cultures, and emphasise shared responsibility for student achievement (MacBeath & Dempster, 2009).

The LfL framework, developed by the Cambridge Network led by John MacBeath, is built around five core principles: maintaining a focus on learning as an activity; creating conditions conducive to learning; promoting dialogue about leadership and learning; sharing leadership among staff and students; and using evidence to inform practice (MacBeath & Dempster, 2009). These principles

represent a shift towards more inclusive, participatory, and evidence-informed approaches to school leadership (Harris & Jones, 2019).

In Ghana, the LfL programme was introduced in 2009 through a collaborative effort between the Ghana Education Service (GES), the Institute for Educational Planning and Administration (IEPA) at the University of Cape Coast (UCC), and the Centre for Commonwealth Education (CCE) at the University of Cambridge. The programme aimed to enhance the leadership competencies of basic school head teachers and improve the quality of education in the long term (Jull, Swaffield, & MacBeath, 2014; Tangonyire, 2018). Following initial success in pilot schools, stakeholders urged nationwide adoption and the inclusion of LfL practices in the Head teachers' Handbook (Jull et al., 2014).

Previous studies documented positive early impacts of the LfL Ghana programme, including innovative approaches such as using mobile technology to support school leaders (Swaffield, Jull, & Ampah-Mensah, 2013) and notable gains in student learning outcomes (Jull et al., 2014; Tangonyire, 2018). However, these studies did not fully address the long-term integration of LfL practices, particularly in terms of how they translate into sustained improvements in teaching and learning across diverse environments.

Fifteen years after its initial implementation, an important question emerges: To what extent have LfL practices been sustained and embedded in Ghanaian basic schools? This study addresses this gap by examining the integration of LfL practices in the Central Region of Ghana, one of the pioneering regions for the programme. The Central Region presents a unique case due to its diverse mix of urban, peri-urban, and rural schools, each with distinct challenges and opportunities, providing an ideal context to explore the depth and sustainability of the LfL programme's impact.

This study is guided by two primary research questions:

1. To what extent have LfL practices been integrated into basic schools in the Central Region of Ghana?
2. What are the benefits and challenges encountered in integrating LfL practices?

By answering these questions, the study contributes to understanding how LfL principles are adapted and sustained in resource-constrained, sub-Saharan African contexts and offers practical insights for policymakers, educational leaders, and international development partners seeking to enhance leadership capacity in basic education.

Literature Review

Theoretical Framework: Instructional Leadership Theory

This study is grounded in Instructional Leadership Theory, which has emerged as one of the most influential frameworks in educational leadership research (Hallinger, 2005). Rooted in the effective schools movement (Edmonds, 1979), instructional leadership emphasises the principal's role in prioritising teaching and learning above administrative tasks. Hallinger and Murphy (1985) expanded this into a three-dimensional framework: defining the school mission, managing the instructional programme, and promoting a positive school learning climate.

Robinson, Lloyd, and Rowe (2008) conducted a meta-analysis finding that instructional leadership had a significantly greater impact on student achievement than transformational leadership styles. Leadership behaviours involving promoting and participating in teacher learning and

development, setting clear academic goals, and monitoring instruction were strongly associated with improved student performance.

In low- and middle-income countries, including Ghana, instructional leadership has gained traction as education systems increasingly focus on accountability and learning outcomes. Oduro (2009) emphasised that in the Ghanaian context, instructional leadership is often constrained by limited resources, excessive administrative duties, and inadequate training. However, when school heads engage teachers in professional learning communities and use performance data to inform decisions, student outcomes tend to improve (Owusu-Acheampong & Essuman, 2022).

The Leadership for Learning Framework

The LfL framework builds on instructional leadership by positioning leadership as a collaborative, learning-centred activity involving all stakeholders (MacBeath & Dempster, 2009). The framework is built around five core principles:

1. Maintaining a focus on learning as an activity – emphasising that learning is the core purpose of schooling and should guide all leadership decisions.
2. Creating conditions conducive to learning – ensuring that the physical, social, and emotional environment supports effective teaching and learning.
3. Promoting dialogue about leadership and learning – encouraging open communication and reflective practice among all stakeholders.
4. Sharing leadership among staff and students – distributing leadership responsibilities to build collective capacity and ownership.
5. Using evidence to inform practice – basing instructional improvements on data and feedback (MacBeath & Dempster, 2009).

Empirical studies support the LfL framework's positive impact on school improvement. Dempster, Lovett, and Flückiger (2011) found that schools in Australia implementing LfL practices showed improvements in literacy and numeracy performance, particularly where leadership was collaborative. In Ghana, Owusu-Acheampong and Essuman (2022) demonstrated that schools applying LfL practices experienced better academic performance.

LfL Implementation in Ghana

The LfL Ghana programme, inspired by the Carpe Vitam programme, focused on five distinctive principles and practices for leadership and learning (Swaffield & MacBeath, 2009). According to Tangonyire (2018), who cited Jull, Swaffield, and MacBeath (2014), the programme aimed to improve the quality of learning through effective school leadership, strengthen the leadership capacity of head teachers, and advocate for leadership development as a prerequisite for appointing school heads.

Following initial implementation in 2009, which achieved success in select schools, stakeholders urged nationwide adoption and recommended including LfL practices in the Head teachers' Handbook (Jull et al., 2014). Tangonyire (2018) examined the integration of LfL practices in Ghana's basic schools and concluded that the framework significantly enhanced school leaders' competencies and improved teaching and learning quality.

Challenges to LfL Integration in Developing Contexts

Research across sub-Saharan Africa has identified persistent challenges to LfL implementation. These include:

Leadership capacity gaps: Many headteachers remain entrenched in traditional hierarchical leadership paradigms, focusing on compliance and administration rather than instructional leadership (Bush & Glover, 2014). Harris and Jones (2019) reported that over 65% of school heads in South African schools felt unprepared to lead LfL-aligned initiatives.

Resource constraints: Schools in developing regions often operate on limited budgets that prioritise basic operational needs over innovative frameworks. Ncube and Tshabalala (2020) found that 70% of primary schools in Zimbabwe lacked funding to support LfL initiatives.

Cultural and structural barriers: Traditional leadership structures discourage teacher participation in leadership roles. Oduro and MacBeath (2017) noted that Ghanaian principals rarely consulted teachers in decision-making processes, stifling innovation.

Policy and administrative barriers: National education policies often lack explicit provisions for LfL, leaving schools without clear guidance or support. Agyemang and Boateng (2020) found that while some Ghanaian policies mentioned leadership and collaboration, they were not prioritised or sufficiently funded.

Research Gap

While previous studies have documented positive early impacts of the LfL Ghana programme, there remains a gap in understanding the long-term integration and sustainability of LfL practices. This study addresses this gap by examining the extent to which LfL practices have been embedded in basic schools fifteen years after initial implementation, identifying both successes and persistent challenges in the Ghanaian context.

Methodology

Research Paradigm and Design

This study is grounded in the pragmatic research philosophy, which prioritises practical outcomes and solutions (Creswell & Creswell, 2018). Pragmatism provides the philosophical foundation for integrating qualitative and quantitative data, allowing researchers to address complex questions that cannot be adequately answered through a single approach (Creswell & Plano Clark, 2018). The study employed a convergent parallel mixed-methods design, involving the simultaneous collection of both qualitative and quantitative data, which were analysed separately and then merged for interpretation (Creswell & Plano Clark, 2018). This design enables researchers to integrate numeric trends with personal experiences, offering a more comprehensive understanding of the research problem.

Study Area

The study was conducted in the Central Region of Ghana, focusing on seven districts that were pioneering districts in implementing the LfL programme: Abura-Asebu-Kwamankese, Agona East, Agona West, Asikuma-Odoben-Brakwa, Cape Coast, Komenda-Edina-Eguafo-Abirem, and Mfantseman. These districts were selected due to their historical involvement in the LfL pilot phase and their diverse mix of urban, peri-urban, and rural schools.

Population and Sample

The target population comprised 756 head teachers of public basic schools from the seven selected districts. Using a census sampling technique, all head teachers were invited to participate in the survey phase. A total of 525 head teachers fully completed and returned the questionnaires,

resulting in a response rate of 69.4%, which is considered adequate for survey-based research in educational contexts (Fincham, 2008; Nulty, 2008).

For the qualitative phase, 10 head teachers were purposively selected from the survey respondents based on their schools' performance ratings. Five head teachers from high-performing schools and five from low-performing schools were selected to participate in semi-structured interviews, enabling a balanced exploration of factors contributing to both success and challenge in LfL integration.

Data Collection Instruments

Questionnaire: A structured questionnaire was designed with five sections. Section one focused on the extent to which 15 LfL practices were being implemented, using a 5-point scale (1 = not being practised at all, 5 = being highly practised). Section two examined the perceived importance of these practices. Section three assessed the benefits of LfL integration (1 = strongly disagree, 5 = strongly agree). Section four addressed challenges (1 = strongly disagree, 5 = strongly agree). Section five collected demographic information. The questionnaire was pre-tested with 30 head teachers in Cape Coast Municipality, yielding a Cronbach's alpha coefficient of 0.89, indicating high internal consistency (Creswell, 2014).

Semi-structured interviews: An interview guide was designed to complement the questionnaire findings, focusing on strategies for integrating LfL practices, factors contributing to successful integration, and challenges encountered. Interviews lasted 10-15 minutes and were audio-recorded with participants' consent.

Data Collection Procedure

Ethical clearance was obtained from the University of Cape Coast Institutional Review Board (UCCIRB). A letter of introduction from the Institute for Educational Planning and Administration facilitated access to schools. Informed consent was obtained from all participants, who were assured of confidentiality and voluntary participation. Quantitative data were collected in June 2024 through self-administered questionnaires, primarily face-to-face, with online and phone options available. Qualitative data were collected in December 2024 through semi-structured interviews with the 10 selected head teachers.

Data Analysis

Quantitative data were entered into SPSS and analysed using descriptive statistics (means and standard deviations) to assess the extent of LfL integration, benefits, and challenges. The following decision rule was applied for interpreting mean scores on benefits and challenges: 1.0-1.4 = Not Sure; 1.4 - 2.4 = Strongly Disagree; 2.4 - 3.4 = Disagree; 3.4 - 4.4 = Agree; 4.4 - 5.0 = Strongly Agree. Qualitative data were transcribed and subjected to thematic analysis, involving identifying recurring themes, concepts, and patterns within the data. Thematic coding was employed to categorise and interpret content, with quotes used to support emerging themes.

Ethical Considerations

The study adhered to established ethical principles, including obtaining informed consent, maintaining participant anonymity, preventing harm, and ensuring confidentiality. All electronic data were password-protected, and hard copies were stored in locked spaces accessible only to the researcher. After study completion, all data were destroyed to prevent unauthorised access.

Results

Demographic Characteristics of Respondents

Of the 525 head teachers who completed the questionnaire, 455 (86.7%) responded regarding their years of headship experience. The largest group (36.0%) had served 5-10 years in their current position, indicating a substantial segment with moderate to long-term leadership experience. A further 23.7% had 1 - 3 years' experience, 21.8% had 3 - 5 years, 9.5% had less than a year, and 8.8% had more than 10 years. Regarding academic qualifications (n=459), the majority held bachelor's degrees (71.5%), while 24.4% held master's degrees and 4.1% held diplomas. This reflects a reasonably well-educated leadership cohort. Gender distribution (n=464) showed significant disparity, with males comprising 65.7% and females 33.6% of respondents. School location (n=459) revealed that 63.4% of schools were in rural areas and 36.2% in urban settings.

Extent of LfL Practice Integration

Table 1 presents head teachers' ratings of the extent to which 15 LfL practices were integrated in their schools, categorised into three groups: highly practised (M ≥ 4.5), well-practised (M = 4.0-4.4), and moderately practised (M < 4.0).

Table 1: Extent of Integration of LfL Practices in Basic Schools

LfL Practice	Mean	SD	Interpretation
Highly Practised (M ≥ 4.5)			
Open and effective communication between head and teachers	4.6	0.74	Highly practised
Transparent communication between head, parents and community	4.5	0.78	Highly practised
Teachers' continuous professional development encouraged	4.5	0.75	Highly practised
Well-Practised (M = 4.0-4.4)			
Focus on learners' academic achievement	4.4	0.82	Well-practised
Information on learners' performance used to enhance teaching	4.3	0.81	Well-practised
School problems solved to foster positive learning environment	4.2	0.88	Well-practised
Favourable school climate for learners and teachers	4.2	0.88	Well-practised
Collaboration among teachers, parents, and community	4.2	0.91	Well-practised

LfL Practice	Mean	SD	Interpretation
Learning experiences prioritised in decision-making	4.2	0.87	Well-practised
Inclusivity and diversity promoted	4.1	0.90	Well-practised
Support for high-quality teaching and learning	4.0	0.98	Well-practised
Supportive culture promoting learners' well-being	4.0	0.90	Well-practised
Moderately Practised (M < 4.0)			
Active community involvement in educational decisions	3.8	1.07	Moderately practised
Equitable distribution of resources	3.6	1.04	Moderately practised
Adequate resources (funding, time, personnel)	3.2	1.10	Moderately practised

Source: Field data (2025)

The findings reveal that three LfL practices are highly integrated: promoting continuous professional development for teachers (M=4.5, SD=0.75), open communication between heads and teachers (M=4.6, SD=0.74), and transparent communication with parents and communities (M=4.5, SD=0.78). Eleven practices are well integrated, with means ranging from 4.0 to 4.4. However, three practices are only moderately integrated: active community involvement (M=3.8, SD=1.07), equitable resource distribution (M=3.6, SD=1.04), and resource mobilisation (M=3.2, SD=1.10).

Benefits of LfL Integration

Table 2 presents head teachers' perceptions of the benefits resulting from LfL integration.

Table 2: Benefits of Integrating LfL Practices

Benefit	Mean	SD	Interpretation
Learners and teachers feel safe, respected, and valued	4.4	0.74	Agree
Teachers benefit from continuous professional development	4.4	0.72	Agree
Increased learners' engagement in learning	4.3	0.71	Agree
Harmonious and supportive school environment	4.3	0.73	Agree

Benefit	Mean	SD	Interpretation
Enhanced staff teaching skills and methodologies	4.3	0.72	Agree
Improved teachers' classroom instructional performance	4.3	0.67	Agree
Improved learners' learning outcomes	4.2	0.74	Agree
Increased learners' literacy and numeracy skills	4.2	0.70	Agree
Improved performance in standardised tests (e.g., BECE)	4.2	0.76	Agree
Increased learner involvement in class discussions	4.2	0.74	Agree
Data-informed decision-making processes	4.2	0.68	Agree
Regular collection and analysis of data	4.1	0.71	Agree
Regular parent and community participation	4.0	0.81	Agree
Addressing diverse needs of all learners	4.0	0.87	Agree
Efficient allocation and management of resources	4.0	0.90	Agree

Source: Field data (2025)

All benefit indicators received mean scores above 4.0, indicating general agreement that LfL integration has produced positive outcomes. The highest-rated benefits relate to school climate (learners and teachers feeling safe, respected, and valued: M=4.4), teacher professional development (M=4.4), learner engagement (M=4.3), and enhanced teaching skills (M=4.3).

Challenges to LfL Integration

Table 3 presents the challenges hindering LfL integration.

Table 3: Challenges Encountered in Integrating LfL Practices

Challenge	Mean	SD	Interpretation
Inadequate school infrastructure (libraries, computer labs)	4.5	0.887	Strongly Agree
Limited funding for teaching and learning activities	4.3	0.931	Agree
Frequent changes in education policies and priorities	4.3	0.946	Agree
Limited headteacher role in teacher recruitment/transfers	4.2	1.062	Agree
Heavy workloads (administrative and extracurricular)	4.0	0.988	Agree
High teacher turnover/attrition	3.8	1.254	Agree
Large class sizes/high student-to-teacher ratios	3.7	1.141	Agree
Apathy among community members	3.7	1.098	Agree
Insufficient leadership training for head teachers	3.6	1.135	Agree
Apathy among teachers/staff	3.5	1.094	Agree

Source: Field data (2025)

Inadequate school infrastructure emerged as the most pressing challenge, with respondents strongly agreeing (M=4.5, SD=0.887). Limited funding (M=4.3), frequent policy changes (M=4.3), and limited head teacher autonomy in teacher recruitment (M=4.2) were also major concerns.

Qualitative Findings: Head Teachers' Strategies and Experiences

Thematic analysis of interviews with 10 head teachers revealed seven key themes regarding how LfL practices are integrated.

Theme 1: Implementation of LfL Practices through Structured Activities

Head teachers reported using diverse strategies to implement LfL practices, including early morning classes, differentiated instruction, quizzes, reading competitions, and learner clubs. As one head teacher explained:

> *"When I joined the staff and realised the children were not doing well, I introduced early reading grade early in the morning, around 6:45 AM to 7:30 AM. It is compulsory for every teacher to take the children through the early reading grade. Then, every Wednesday, instead of having all-morning worship, we try to use about 15 minutes for worship and about 30 minutes for phonetics and reading. Then, every Friday, we hold a reading competition and quizzes*." (John, Male, Low-performing school)

Another described a comprehensive approach:

> *"At my school, we implement accelerated learning, which means we start our lessons one hour before the regular class time. We also conduct remedial activities and other learning support initiatives. We collaborate with stakeholders, including the SMC chairman, PTA, and other community members, so that they can help us. They come to check on the children, how they are learning."* (Mary, Female, Low-performing school)

Theme 2: Teacher Support and Professional Development

Head teachers emphasised strengthening Professional Learning Communities (PLCs) as essential for building teacher capacity. A head teacher from a high-performing school described:

> *"We have a PLC being implemented in my school. We do it every Thursday, where subject difficulties are discussed among the teachers. Aside from that, we also do exchange teaching. Intermittently, I moved some of the upper primary teachers to teach at the JHS; JHS teachers also come to teach the upper primary, as well as the KG and lower primary."* (Catherine, Female, High-performing school)

Another added:

> *"I am building up the teachers' dossier, and all these factors are taken into account in my plan. Nobody wants a negative report on their record, so everyone is doing their best to support the programmes that we have been implementing."* (John, Male, Low-performing school)

Theme 3: Parental and Community Involvement

Head teachers described innovative approaches to engaging parents and communities:

> *"Before you enrol your ward, I will meet the parents. My school is only JHS... Before we accept your word, we will meet the parents and provide you with the school's code of conduct, which we will read to you for your acceptance. This includes guidelines on attending meetings and the expected conduct within the school. I tell them that this is our school culture."* (Lucy, Female, High-performing school)

Another explained:

> *"We have one or two projects ongoing when we call for PTA meetings, and we would like some assistance; they support us. Even now, they have supported us, despite the large class sizes, and we have heat in the classrooms; they have also supported us by providing ceiling fans for the JHS classrooms."* (Felicia, Female, Low-performing school)

Theme 4: Prioritising Learner Development

Head teachers reported intentional focus on holistic learner development through co-curricular activities:

> *"We have a debating club, a STEM club, and a robotics club in the school. During their club meetings, especially STEM and those with a humanities focus, we usually emphasise the importance of girls making bold decisions to overcome the fear of mathematics. Now, we have encouraged more girls to pursue sciences."* (Lucy, Female, High-performing school)

Theme 5: Monitoring and Evaluation

Head teachers used various tools to monitor teaching and learning:

> *"Yes, I attend the class with a monitoring tool. The monitoring tool is designed in such a way that I will go to the class and look for something specific that I am seeking... With the tool, I can assess the teacher on a scale of one to five to determine whether they were able to implement it or encountered challenges. Afterwards, I discussed my observation with the teacher."* (Broni, Male, Low-performing school)

However, some head teachers acknowledged limitations:

"Well, I do monitor, but not adequately. I have to tell the truth." (Felicia, Female, Low-performing school).

Theme 6: Sustaining and Expanding Successful Practices

Head teachers emphasised institutionalising effective practices:

> *"We still need to maintain our good relationship. Usually, when we meet, I advise them and remind them that we are each other's keepers... I also encourage and motivate them to do their best. Even in my absence, they will do what is right, and when I return, they will provide me with feedback."* (Baidoo, Male, High-performing school)

Theme 7: Overcoming Challenges through Innovation

Head teachers demonstrated remarkable creativity in addressing resource constraints:

> *"One of them is a financial challenge. Sometimes, capitation grants may not be available, and we need to explore alternative options; however, our primary support comes from the school farm. We sometimes harvest our cabbage and maize, and use part of the money to motivate the teachers and the children."* (Baidoo, Male, High-performing school)

Another described addressing teacher shortages:

> *"Some of the challenges are that this school is in the village and is not on the main road, so teachers are not willing to come and teach here. To address this, we use volunteer teachers... we do a lot of in-service training for them, and they are now able to teach."* (Broni, Male, Low-performing school)

Discussion

Extent of LfL Integration

The findings reveal that fifteen years after its introduction, LfL practices have been substantially integrated into basic schools in Ghana's Central Region. The high levels of integration for practices related to communication, professional development, and learner focus indicate that head teachers have internalised core LfL principles. This finding aligns with Tangonyire's (2018) observation that the LfL framework significantly enhanced school leaders' competencies in Ghana.

The strong emphasis on continuous professional development (M=4.5) reflects head teachers' understanding that teacher capacity building is central to improving learning outcomes. This aligns with Darling-Hammond, Hyler, and Gardner's (2017) assertion that effective CPD programmes equip teachers with innovative pedagogical strategies and foster reflective practice. Similarly, the high rating for open communication between head teachers and teachers (M=4.6) supports

Leithwood, Harris, and Hopkins' (2020) identification of effective communication as crucial for transformational leadership.

However, the moderate integration of resource-related practices (M=3.2-3.6) reveals persistent challenges. The difficulty in mobilising adequate resources (M=3.2) echoes Oduro's (2009) observation that Ghanaian head teachers often assume leadership roles without adequate material support. This finding also aligns with Ncube and Tshabalala's (2020) research in Zimbabwe, where 70% of schools lacked funding to support LfL initiatives.

Benefits of LfL Integration

The positive outcomes reported across all benefit indicators demonstrate LfL's transformative potential. The highest-rated benefits relate to school climate (M=4.4), teacher development (M=4.4), and learner engagement (M=4.3). These findings support Thapa et al.'s (2013) research linking positive school climate to improved academic performance and reduced behavioural issues. They also align with Guskey's (2002) emphasis on CPD as essential for maintaining high-quality teaching.

The agreement that LfL integration has improved learners' learning outcomes (M=4.2), literacy and numeracy skills (M=4.2), and performance in standardised tests (M=4.2) provides empirical support for the LfL framework's effectiveness in the Ghanaian context. This corroborates Owusu-Acheampong and Essuman's (2022) finding that schools applying LfL practices experienced better academic performance in the Central Region.

Persistent Challenges

Despite these successes, significant challenges continue to constrain full LfL implementation. The identification of inadequate infrastructure as the most pressing challenge (M=4.5) reflects systemic underinvestment in Ghana's basic education sector. Adeyemi and Adu (2020) affirm that robust infrastructure forms the bedrock of effective education delivery, and its absence compromises instructional quality and student engagement.

Limited funding (M=4.3) and frequent policy changes (M=4.3) represent additional systemic barriers. Harris and Jones (2020) note that adequate funding is indispensable for sustaining LfL practices, while Hallinger and Wang (2021) emphasise that policy coherence is essential for sustained implementation. The finding that head teachers have limited say in teacher recruitment and transfers (M=4.2) resonates with Harris and Muijs' (2019) argument that school heads should be given greater autonomy to align staff expertise with instructional goals.

Head Teacher Innovation and Resilience

The qualitative findings reveal remarkable creativity among head teachers in navigating constraints. The establishment of school farms to generate income, recruitment of volunteer teachers from communities, and partnerships with donors for feeding programmes demonstrate what might be termed "distributed resource mobilisation" – extending distributed leadership concepts (Spillane, 2006) to include shared responsibility for resource acquisition.

These innovations challenge deficit narratives about African educational leadership and highlight head teachers' agency in creating enabling conditions for learning despite systemic constraints. As one head teacher noted, "I use my own money" (Baidoo), reflecting personal commitment that extends beyond formal role requirements.

Implications for Theory and Practice

The findings contribute to the theoretical understanding of how LfL principles are adapted in resource-constrained contexts. They suggest that while the core LfL principles remain relevant, their implementation requires contextual adaptation that recognises the realities of under-resourced schools. The study extends MacBeath and Dempster's (2009) framework by demonstrating how "creating conditions conducive to learning" must be interpreted to include head teacher-led resource mobilisation and community partnership building in contexts where government provision is inadequate.

For practice, the findings highlight the need for leadership development programmes that prepare head teachers not only for instructional leadership but also for strategic resource mobilisation, community engagement, and policy navigation. The variation in monitoring practices across schools points to the need for standardised guidelines and training in data use for school improvement.

For policy, the persistent challenges of inadequate infrastructure, limited funding, and policy instability require systemic responses. The Ministry of Education and Ghana Education Service must address these foundational issues if LfL's full potential is to be realised.

Conclusion

This study assessed the integration of Leadership for Learning practices in basic schools in Ghana's Central Region, fifteen years after the programme's introduction. The findings reveal substantial integration of core LfL practices, particularly those related to communication, professional development, and learner focus. Head teachers reported positive outcomes, including enhanced teacher performance, improved learner engagement, and safer school climates. However, significant challenges persist, particularly inadequate infrastructure, limited funding, frequent policy changes, and constrained head teacher autonomy.

The study contributes to understanding how LfL principles are adapted and sustained in resource-constrained, sub-Saharan African contexts. It demonstrates that while systemic barriers constrain full implementation, head teachers demonstrate remarkable creativity and resilience in creating enabling conditions for learning. The findings have implications for leadership development programmes, education policy, and international development partnerships seeking to enhance leadership capacity in basic education.

Limitations and Future Research

This study has several limitations. First, data were collected exclusively from head teachers in the Central Region, limiting generalisability to other regions. Second, the study relied on self-reported data, which may be subject to social desirability bias. Third, the cross-sectional design captured a single point in time, limiting the ability to observe changes over time.

Future research should consider longitudinal studies to track LfL integration over extended periods, comparative studies across regions, and investigations of the indirect mechanisms through which LfL influences student outcomes. Research exploring how head teachers' innovative resource mobilisation strategies can be systematised and scaled would also be valuable.

Recommendations

Based on the findings, the following recommendations are proposed:

1. For head teachers: Continue strengthening professional learning communities and stakeholder engagement while developing strategic resource mobilisation skills. Document and share innovative practices with colleagues.
2. For the Ghana Education Service: Address infrastructural deficits, ensure consistent funding for teaching and learning, minimise frequent policy changes, and grant head teachers greater involvement in teacher recruitment and transfers.
3. For leadership development programmes: Incorporate training in resource mobilisation, community engagement, and data-informed decision-making alongside instructional leadership content.
4. For international development partners: Support long-term, system-strengthening initiatives rather than short-term projects, and invest in documenting and scaling head teacher-led innovations.

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RELATIONSHIP BETWEEN AFRICAN MENTORSHIP PRACTICES AND IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOALS IN PUBLIC UNIVERSITIES IN ANAMBRA STATE, NIGERIA

Dr. Chika Nonye Eziamaka
Department of Educational Management and Policy.
Faculty of Education
Nnamdi Azikiwe University, Awka, Anambra State, Nigeria
Email - cn.eziamaka@unizik.edu.ng
Phone no - 08168983795

Dr. Patience Obiageli Obineme
Department of Educational Management and Policy
Faculty of Education
Nnamdi Azikiwe University, Awka, Anambra State, Nigeria
Email - po.obineme@unizik.edu.ng
Phone no - 08066124487

Dr. Regina Nwamaka Chukwu
Department of Educational Management and Policy
Faculty of Education, Nnamdi Azikiwe University,
Awka, Anambra State, Nigeria
Email: nr.chukwu@unizik.edu.ng
Phone: 08037404360

Dr. Loveline Benataokwu Ekweogu
Department of Educational Management and Policy
Nnamdi Azikiwe University, Awka, Anambra State, Nigeria
Email - ib.ekweogu@unizik.edu.ng
Phone no -08063498722

Abstract
The study examined the relationship between African mentorship practices and implementation of sustainable development goals in public universities in Anambra State, Nigeria. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. Correlational survey research design was adopted for the study. The population of the study comprised of 123 (300 level) undergraduates of the Department of Educational Management in the Faculties of Education of the two public universities in Anambra State in the 2025/2026 academic session. The sample of 123 undergraduates of the Department of Educational Management was used for the study. Multi-staged sampling procedure was used to determine the sample for the study. Two structured questionnaires which was developed by the researcher and validated by three experts were used to collect data for the study. The instrument was subjected to a pilot test on 30 undergraduates in public universities in Enugu State, Nigeria. Pearson product moment correlational analysis was used to analyse data for the study. Findings revealed that there is a high positive relationship between intergenerational knowledge transfer and implementation of sustainable development goals in public universities in Anambra State, Nigeria. Findings of the study also revealed that community value based mentorship has a high positive relationship with the implementation of sustainable development goals in public

universities in Anambra State, Nigeria. Furthermore, African mentorship practices have statistically significant relationship with the implementation of sustainable development goals in public universities in Anambra State, Nigeria. The researcher concluded that African Mentorship Practices have positive and significant with the implementation of sustainable development goals in public universities in Anambra State. Based on the findings, it was recommended that management of universities should formally integrate intergenerational mentorship structures into academic policies by ensuring that senior academics are systematically paired with junior lecturers and postgraduate students for continuous academic guidance and knowledge transfer. It was also recommended that management of public universities should strengthen community and value-based mentorship programmes by embedding ethical training, civic responsibility, and sustainability awareness into both academic and extracurricular activities.

Keywords: African Mentorship Practices, Sustainable Development Goals, Implementation, Universities, Undergraduates

Introduction

The United Nations adopted the Sustainable Development Goals (SDGs) in 2015. They are a set of goals for the world to work toward by 2030 in order to solve the most important social, economic, and environmental problems. The 2030 Agenda says that the goals are all connected and can't be separated. It also says that sustainable development must include human well-being, environmental protection, and shared wealth. In this sense, the SDGs are more than just a statement of what the world wants; they are also a practical way to rethink institutions, policies, and systems in ways that will help everyone develop in the long term (United Nations, 2015). The implementation of this global framework has varied significantly across different parts of the world, so we need to examine how the SDGs have performed in Africa.

The implementation of the SDGs has varied across Africa, and in many cases, progress has been too slow. The Africa Sustainable Development Report 2024 says that progress on the continent has been slow. Only a small number of measurable goals are on track; many others need significant changes in policy, institutions, and finances. This means that African's problem is not just getting people to accept the SDGs as a plan for development; it's also about turning those goals into systems, institutions, and ways of social action that make sense in Africa (United Nations Economic Commission for Africa, 2024). This implementation challenge is what has made stakeholders pay attention to the institutions that are supposed to turn development promises into real results, and universities are one of the most important of these.

Universities are important to attain the SDGs since they produce new information, teach skilled workers, influence values, and provide research-based solutions to societal issues. UNESCO's Global Independent Expert Group on the Universities and the 2030 Agenda argues that colleges and universities may help with sustainability transitions in a unique way by performing research, teaching, coming up with new ideas, and being active in the community. According to Ashida (2022), higher education helps with more than simply SDG 4, which is about receiving a decent education. Being active in education, society, and research also helps with the overall development mission. Since universities play an important role in the implementation of sustainable development globally, that they are investigated.

The Nigeria government has officially integrated the SDGs into its national development plan in Nigeria. However, the extent to which strategic development has been implemented in Nigeria remains unclear. Studies have shown that knowledge, institutional integration, and practical engagement with sustainable development remain in a developmental phase rather than being

firmly established. Amaonye and Anyaeji (2024) posited that undergraduate awareness and perception of the Sustainable Development Goals was low and thus necessitate the promotion of action-oriented programmes in universities. Sadly, this ugly scenario is getting worse in some universities in Anambra State, Nigeria. This issue is more worrisome in Anambra State, Nigeria where there has been more focus on the importance of university outputs for development.

The situation in universities in Anambra State appears to be worrisome because of the graduates of public universities seem not to have the necessary skills and competence that match the human capital needs of the society required for sustainable development. Offor and Nwaru (2024) reported that poor funding of universities is a major cause of the poor state of universities in South-East Nigeria. This is reflected in inadequate practical sessions, limited fieldwork, overcrowded classrooms and compromised teaching quality in some universities in the zone. Furthermore, Makwe et al. (2026) reported that lack of 21st century skill acquisition training negatively affects the career readiness of undergraduates in public universities. This situation made Okoye and Ilechukwu (2025) to suggest that exposing students to internship would improve students' employability skills. This suggests that the problem is not just access to university education, but the kind of educational training being provided to students in universities.

One major critique of the contemporary university system is its continuous overdependence on westernised modes of training that focus more on abstract theory over practical interaction based on local circumstances. It has been stated that many universities in Africa still function under the colonial or Eurocentric knowledge systems that do not effectively reflect indigenous epistemologies, local problem-solving traditions or development demands of the African society. Scholars like Gumbo et al. (2024) averred that universities in Africa are shaped by colonial methods of education and training. Sadly this system of education, has only resulted to the generation of graduates who may be eloquent and academically credentialed, however poorly prepared with practical competence for tackling real-life social challenges; hence, the hunt for a more context-responsive educational strategy.

Reports in Africa describe mentoring and educational formation in ways that are relational, communal, transformative and culturally grounded. According to Khumalo and Ndlovu (2024), mentoring is a form of transformation in academia. In the same vein, Biljohn et al. (2024) defined African mentorship support as involving guidance, development, networking and structured support. On the other hand, Kotze (2025) based on the Ubuntu perspective, viewed mentoring as a humane, collaborative process in which a knowledgeable elder offers support, compassion and direction to a novice. Based on these view, African mentorship practices in the context of this study are culturally rooted processes through which knowledge, skills, values and social responsibility are transmitted in relational and communal settings for the development of both the individual and society. Once African mentorship practices are understood in this way, it becomes important to identify the specific forms through which they operate in educational and community life.

From literature, it is clear that African mentorship practices are expressed in several interconnected forms. One form is indigenous apprenticeship, through which practical knowledge is transmitted from experienced persons to younger learners in real-life settings (Odeh et al., 2025). It is a traditional system of learning where skills, knowledge, and cultural practices are passed down directly from elders or master practitioners to younger members within an Indigenous community. Unlike formal schooling, it happens through hands-on participation, observation, and storytelling embedded in daily life and ceremony, ensuring cultural continuity.

It covers everything from hunting, farming, weaving, and medicine to governance and spiritual practices, keeping Indigenous ways of knowing alive across generations.

Another form is Ubuntu-oriented pedagogic and social formation, which emphasises relationality, mutual care, inclusion and shared responsibility in the development of learners (Ngubane & Makua, 2021; Makhanya & Mzinyane, 2023). It shifts education from individual competition to collaborative knowledge-building, where teachers and learners co-create understanding, respect diverse experiences, and prioritize collective wellbeing and ethical responsibility alongside academic goals. Other forms are formal and semi-formal academic mentoring structures that support growth through guidance, networks and developmental relationships (Biljohn et al., 2024). While these forms are broad and overlapping, the present study concentrates on two dimensions that are especially relevant to university education and sustainable development which intergenerational knowledge transfer and community value-based mentorship.

Intergenerational knowledge transfer is the movement of knowledge, experience, practical wisdom and culturally valued competencies from older or more experienced persons to younger or less experienced ones. This supports the views in African-centred literatures. Odeh et al. (2025) revealed how practical and entrepreneurial knowledge is transferred through sustained mentor–mentee relationships in the Igbo apprenticeship system. In the same vein, Biljohn et al. (2024) highlighted the importance of mentorship structures that facilitate developmental support across experience levels. Similarly, Kotze (2025) stated that in intergeneration knowledge transfer, novice professionals get guidance from a knowledgeable elder whose support extends beyond technical instruction to humane and relational accompaniment. Intergenerational knowledge transfer is the movement of skills, technology, research, and practices across borders through trade, education, migration, and collaboration, accelerating innovation where local capacity is limited. Its impact depends on absorptive capacity, trust, and institutional fit, since knowledge that works in one context often requires adaptation to take root elsewhere. In the context of this study, intergenerational knowledge transfer is defined as the intentional transmission of practical knowledge, professional experience and socially relevant wisdom from senior academics, mentors or elders to younger members of the university community. Since knowledge alone is not sufficient for sustainable development, the next dimension of African mentorship must be understood in relation to the values that guide how such knowledge is used in the society.

Community value-based mentorship deals with the transmission of ethical, relational and communal values that shape responsible citizenship and socially useful action. This orientation is strongly grounded in the Ubuntu school of thought. Ngubane and Makua (2021) explained that Ubuntu pedagogy promotes co-existence, inclusivity and social cohesion within educational practice. Similarly, Makhanya and Mzinyane (2023) defined Ubuntu as an emancipatory framework based on collectiveness, togetherness and justice. Furthermore, Mugumbate et al. (2024) presented Ubuntu as a philosophy of shared values and relational humanity with clear implications for education in Africa. Community value-based mentorship ties guidance to shared principles like trust, reciprocity, and collective growth, so mentors and mentees advance together rather than in a top-down exchange. It works because the relationship is anchored in what the community actually cares about, making accountability personal and the skills learned directly useful to the group. Thus, community value-based mentorship in this study refers to a form of mentoring through which learners are guided to internalise responsibility, solidarity, mutual respect and commitment to the common good. When combined with intergenerational knowledge transfer, this value-orientated form of mentorship offers a compelling indigenous framework for examining how universities may better contribute to sustainable development.

The need for the present study consequently derives from the apparent conflict between the known developmental purpose of universities and the persistent evidence that many graduates are not being developed in sufficiently practical, ethical and context-responsive ways. In Anambra State, concerns about weak SDG awareness, limited practical training, poor employability preparation and the wider misalignment between university outputs and societal needs indicate that public universities may not yet be contributing optimally to sustainable development (Amaonye & Anyaeji, 2024; Offor & Nwaru, 2024; Makwe et al., 2026; Okoye & Ilechukwu, 2025). At the same time, African scholarship continues to show that indigenous knowledge systems, Ubuntu-oriented learning and culturally grounded mentoring can provide viable alternatives to overly westernised educational approaches (Gumbo et al., 2024; Nnama-Okechukwu et al., 2023; Ngubane & Makua, 2021). It is against this context that the present study examines the relationship between African mentorship practices and the execution of sustainable development goals in public universities in Anambra State, Nigeria.

Statement of the Problem

The role of public universities in the advancement of the Sustainable Development Goals is defined by the strategic mandate that requires these institutions to use teaching, research, community service, institutional leadership, and value formation to help achieve the set goals. As institutions in Anambra State, these universities are supposed to create graduates, develop new ideas, and come up with policies that address social, economic, and environmental problems that hinder sustainable development. However, despite the growing relevance of the SDGs in academia, these institutions' efforts to implement these goals are generally focused on developing policies rather than promoting them through other activities including cultural ones. One such cultural activity is mentorship, but its role in advancing SDGs in public universities has been overlooked. In Africa, mentorship is not only a pedagogical process. Instead, it is based on cultural values and includes such aspects as guidance, advice, and moral training of people from younger generations by those who belong to older ones. The practice of mentorship has potential in forming attitudes, behavior, approaches to leadership, and responsibility that are required to facilitate sustainable development. However, in numerous universities, mentorship practices remain either informal, inconsistent, unconnected to institutional practices of sustainable development that include such aspects as fairness, responsible leadership, environmental awareness, social inclusiveness, and sustainable institutional development.

Therefore, the problem of interest is the following. Although universities in Anambra State need to actively participate in the achievement of SDGs, there is no reliable evidence concerning how African mentorship practices can affect this process. In other words, it needs to be clarified whether mentorship practices promote the creation of conditions that are favorable for SDGs' successful realisation. Is there any relation between the existence of strong and well-established mentorship relationships and effective implementation of the SDGs in these institutions? Or perhaps the lack of appropriate practices prevents people from participating in and implementing these goals at all? Additionally, very few attempts have been made to study indigenous mentoring practices in Africa. Hence, this subject matter remains poorly investigated, and the relationship between these phenomena is not fully understood yet.

Therefore, the research question raised above represents a substantial gap in existing knowledge since, if it remains unanswered, attempts to achieve sustainable development will fail due to the ignorance of relevant aspects. The current study is focused on examining this issue in universities in Anambra State.

Purpose of the Study

The main purpose of the study was to examine the relationship between African mentorship practices and the implementation of sustainable development goals in public universities in Anambra State, Nigeria. Specifically, the study examined the relationship between:

1. Intergenerational knowledge transfer and implementation of sustainable development goals in public universities in Anambra State, Nigeria.
2. Community value based mentorship and implementation of sustainable development goals in public universities in Anambra State, Nigeria.

Research Questions

The following research questions guided the study:

1. What is the relationship between intergenerational knowledge transfer and implementation of sustainable development goals in public universities in Anambra State, Nigeria?
2. What is the relationship between community value-based mentorship and implementation of sustainable development goals in public universities in Anambra State, Nigeria?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

1. There is no significant relationship between intergenerational knowledge transfer and implementation of sustainable development goals in public universities in Anambra State, Nigeria.
2. There is no significant relationship between community value-based mentorship and implementation of sustainable development goals in public universities in Anambra State, Nigeria.

Methods

The research adopted correlational survey design. It was considered the most appropriate for the study because it helped to determine the relationship between the independent and dependent variables. The design enabled the determination of the direction and magnitude of the relationship existing between the variables. The research was carried out in Anambra State, Nigeria where there are two public universities offering Educational Management programme in the Faculty of Education. These universities are; Nnamdi Azikiwe University, Awka and Chukwuemeka Odimegwu Ojukwu University, Igbariam Campus. The population consisted of all the 123 300-level undergraduate students enrolled in the Department of Educational Management in the Faculties of Education in the two universities in the 2025/2026 academic year. All the members of the population were the sample of the study because the total population size was small (123 300-level undergraduate students). This is why a census sample technique was used since all the 123 300-level undergraduate students were sampled and participated in the study. Two structured questionnaire designed by the researcher was used in collecting data. The first questionnaire is titled African Mentorship Practices Questionnaire (AMPQ). It contained 22 items spread in two clusters. Cluster 1 contains 12 items on intergenerational knowledge transfer and Cluster 2 contained 10 items on community value based mentorship. The second instrument titled Implementation of Sustainable Development Goals Questionnaire (ISDGQ) contained 15 items collecting information on implementation of SDGs in public universities. The questionnaire items were designed in accordance with the aims, objectives, research questions and hypotheses of the research.

To confirm the appropriateness of the items in measuring the variables being investigated in the study, experts' validation were carried out to make sure that the items are clear and adequate

enough. Based on the feedback and advice given by the experts, changes were made to improve instrument validity before its use. Also, a pilot test was conducted involving 30 undergraduates from Enugu State University, Nigeria who were not included in the study to test the instrument suitability. The questionnaires were distributed and collected personally by the researcher with the help of research assistants where necessary. Data retrieved from the pilot test using Cronbach alpha yielded reliability coefficients of 0.80 for African Mentorship Practices Questionnaire (AMPQ) and 0.84 for Implementation of Sustainable Development Goals Questionnaire (ISDGQ). Personal distribution of questionnaires ensured high response rate and completeness of the instrument. Out of 123 copies of questionnaires distributed, 109 copies were retrieved in good condition and used for the analysis of data.

Data obtained from the study was analyzed using Pearson Product Moment Correlation Coefficient. Based on the correlation coefficient, the degree and direction of the relationship were interpreted following conventional rules of correlation decision-making. Interpretation showed whether there was a direct or indirect relationship depending on the sign of the coefficient. While null hypotheses were subjected to test at the 0.05 level of significance. Null hypothesis was rejected when P-value was less than 0.05 otherwise it was accepted.

Results

Research Question 1: What is the relationship between intergenerational knowledge transfer and implementation of sustainable development goals in public universities in Anambra State, Nigeria?

Hypothesis 1: There is no significant relationship between intergenerational knowledge transfer and implementation of sustainable development goals in public universities in Anambra State, Nigeria.

Table 1: Summary of Pearson Correlation Analysis and Test of Significance between Intergenerational Knowledge Transfer and Implementation of Sustainable Development Goals in Public Universities in Anambra State, Nigeria.

Variables		Intergenerational Knowledge Transfer	Implementation of Sustainable Development Goals	Remark
Intergenerational Knowledge Transfer	Pearson Correlation	1	0.710**	
	Sig. (2-tailed)		0.000	High Positive/Significant Relationship
	N	109	109	
Implementation of Sustainable Development Goals	Pearson Correlation	0.711**	1	
	Sig. (2-tailed)	0.000		
	N	109	109	

** Correlation is significant at the 0.05 level (2-tailed).

Table 1 reveals that the Pearson's Correlation Coefficient is r = 0.710. This indicates a strong positive relationship between intergenerational knowledge transfer and implementation of sustainable development goals in public universities in Anambra State, Nigeria. This implies

that in universities where three intergenerational knowledge transfer, there will be improvements in the implementation of the sustainable development goals in public universities. Thus, there is a high positive relationship between intergenerational knowledge transfer and implementation of sustainable development goals in public universities in Anambra State, Nigeria. Furthermore, the p-value of 0.000 is less than the 0.05 level of significance. Therefore, the null hypothesis is rejected. This indicates that there is a statistically significant relationship between intergenerational knowledge transfer and implementation of sustainable development goals in public universities in Anambra State, Nigeria

Research Question 2: What is the relationship between community value-based mentorship and implementation of sustainable development goals in public universities in Anambra State, Nigeria?

Hypothesis 2: There is no significant relationship between community value-based mentorship and implementation of sustainable development goals in public universities in Anambra State, Nigeria.

Table 2: Summary of Pearson Correlation Analysis and Test of Significance between Community Value Based Mentorship and Implementation of Sustainable Development Goals in Public Universities in Anambra State, Nigeria.

Variables		Community Value Based Mentorship	Implementation of Sustainable Development Goals	Remark
Community Value Based Mentorship	Pearson Correlation	1	0.723**	
	Sig. (2-tailed)		0.000	High Positive/Significant Relationship
	N	109	109	
Implementation of Sustainable Development Goals	Pearson Correlation	0.723**	1	
	Sig. (2-tailed)	0.000		
	N	109	109	

** Correlation is significant at the 0.05 level (2-tailed).

Data in Table 2 reveals that the Pearson's Correlation Coefficient is r = 0.723. This indicates a strong positive relationship between community value-based mentorship and implementation of sustainable development goals in public universities in Anambra State, Nigeria. This implies that in universities where community value based mentorship, there will be improvements in the implementation of the sustainable development goals in public universities. Thus, there is a high positive relationship between community value based mentorship and implementation of sustainable development goals in public universities in Anambra State, Nigeria. Furthermore, the p-value of 0.000 is less than the 0.05 level of significance. Therefore, the null hypothesis is rejected. This indicates that there is a statistically significant relationship between

community value-based mentorship and implementation of sustainable development goals in public universities in Anambra State, Nigeria

Discussion

From the results of the analysis, there is a high positive correlation between intergenerational knowledge transfer and the implementation of SDGs in public universities in Anambra State, Nigeria. This means that the purposeful transfer of practical knowledge, professional experience, cultural wisdom, and social competence from more senior academics to junior members of the academic community is associated with effective SDG implementation. The ability of intergenerational knowledge transfer to equip students with the knowledge and skills necessary for the successful realization of the sustainable development agenda means that universities practicing this approach are highly likely to promote sustainable values and practices among themselves. This is consistent with the findings of Odeh et al. (2025), who discovered effective transfer of practical and entrepreneurial knowledge through mentor-mentee relationships in the Igbo apprenticeship system. Biljohn et al. (2024) also emphasize the need for mentorship systems that facilitate the creation of developmental opportunities based on experience. In addition, according to Kotze (2025), intergenerational knowledge transfer involves more than just teaching technical skills but also providing humane accompaniment to individuals in the pursuit of meaningful development.

Furthermore, the analysis reveals a significant correlation between intergenerational knowledge transfer and the implementation of SDGs in public universities in Anambra State, Nigeria. The result shows that there is a strong relationship between these two variables in the sample data set. As a consequence, this suggests that intergenerational knowledge transfer can be considered as a key indigenous mentorship resource that contributes significantly to SDG achievement. The finding, therefore, reinforces the idea that higher education institutions should go beyond the teaching of technical skills and knowledge and adopt mentorship systems that prepare graduates for practical living. Consistent with the views of Amaonye and Anyaeji (2024), Offor and Nwaru (2024), Makwe et al. (2026), and Okoye and Ilechukwu (2025), inadequate training, poor responsiveness to societal needs, and ineffective graduate development programs still remain challenges that hamper the contribution of universities to SDG implementation. Promoting intergenerational mentoring relationships might therefore help overcome some of these obstacles and promote SDG implementation among universities.

Furthermore, the results show that there is a high positive correlation between community value-based mentorship and SDG implementation in public universities in Anambra State, Nigeria. Universities that promote the internalization of values such as responsibility, solidarity, mutual respect, inclusivity, and commitment to the common good among students and Faculty are highly likely to realize SDGs effectively. Community value-based mentorship ensures that not only knowledge but also other relational and ethical values are imparted to students in ways that will enable them to apply what they learn for sustainable development. The finding is in line with the observations made by Ngubane and Makua (2021) that Ubuntu pedagogy creates a basis for peaceful coexistence, inclusivity, and unity among learners. This is also consistent with the views of Makhanya and Mzinyane (2023) that Ubuntu is a liberating paradigm based on principles of togetherness and social justice.

Findings also revealed that there is a statistically significant relationship between community value-based mentorship and the implementation of SDGs among public universities in Anambra State, Nigeria. The result reveals that there is an apparent association between community value-based mentorship and SDG implementation among public universities in Anambra State, Nigeria.

This suggests that mentorship based on community values is an effective indigenous way of contributing positively to the implementation of SDGs among higher education institutions in the area. It is therefore true that universities can do better in their efforts to achieve SDGs by incorporating African relational values in their mentorship programs. Based on the findings of the study, African-centered scholarship remains a good alternative to westernized higher education paradigms.

Conclusion

The finding of the study revealed that African mentorship practices were significantly related to the implementation of SDGs among public universities in Anambra State, Nigeria. Specifically, intergenerational knowledge transfer and community value-based mentorship demonstrate high positive correlations with SDG implementation in the sample. The implication of the results is that increasing knowledge transfer across generations and adopting mentorship practices based on communal values enhances universities' contributions to sustainable development. Accordingly, African mentorship practices offer an indigenous approach for improving SDG implementation in public universities in Anambra State, Nigeria.

Recommendations

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

1. The management of universities in Anambra State, Nigeria should introduce intergenerational mentorship programs that would ensure effective transfer of knowledge, experience, and socially relevant wisdom from more experienced academics and practitioners to students.
2. Faculties and Departments should introduce community value-based mentorship as part of student development programs in order to cultivate values such as responsibility, solidarity, mutual respect, and commitment to the common good.
3. Government agencies, university authorities, and educational policymakers should organize training programs for strengthening African mentorship practices as a strategy for enhancing SDG implementation among universities.

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ARTIFICIAL INTELLIGENCE IN ESL CLASSROOM: A STUDY EPISTERMIC INFLUENCE AND CULTURAL REPRESENTATION IN NIGERIAN EDUCATION

[1]Dr. ENU, Evelyn Nwene & [2]AIMASIKO, Omobolaji Ganiyu
[1]Department of Primary and Early Childhood Education,
Faculty of Specialised and Professional Education
Emmanuel Alayande University of Education, Oyo.
Oyo state Nigeria.
evelynazuka16@gmail.com /enuen@eauedoyo.edu.ng
07039394766

[2]Department of Foundation and Curriculum Studies,
Faculty of Specialised and Professional Education
Emmanuel Alayande University of Education, Oyo,
Oyo state Nigeria
Abufolarin4all@gmail.com / aimasikoog@eauedoyo.edu.ng
08066665414/ 08057114829

Abstract
Despite the increasing interest of AI in education, there remains questions as to whether they are epistemic and cultural implications within ESL classrooms in a developing country like Nigeria. This study examines the epistemic influence and cultural representation of Artificial Intelligence (AI) in ESL classrooms within the Nigerian educational context. The study adopted a mixed-methods approach, data were collected from 150 students through questionnaires and 20 students were interviewed using semi-structured interviews. Quantitative data were analysed using descriptive statistics and one-way Analysis of Variance (ANOVA), while qualitative data were analysed using thematic analysis. The findings revealed that AI usage significantly influences learners' epistemic engagement, with high-frequency users demonstrating over reliance on AI-generated knowledge. Similarly, significant differences were observed in perceptions of cultural representation, with increased AI usage associated with greater awareness of cultural bias in AI outputs. Qualitative findings further indicated that learners perceive AI as an authoritative source of knowledge, although concerns were raised about cultural misrepresentation and overdependence. The study concludes that AI plays a transformative role in ESL education by shaping both knowledge construction and cultural understanding. The study contributes to ongoing discourse on AI in education by providing empirical evidence from a developing context and offers practical implications for educators and policymakers.

Keywords: Artificial Intelligence, Epistemic Influence, Cultural Representation, ESL

Introduction

The educational sector in Nigeria has experienced transformation with the integration of Artificial intelligence (AI). This has brought tremendous changes in to pedagogical practices across the globe particularly in English as second language (ESL) classrooms. In multilingual countries like Nigeria where ESL instructions is central and vital in the educational scene, the emergence of artificial intelligence(AI) tools provided avenue for creativity ,innovation and challenges for effective implementation. Beyound its function, use and application, artificial intelligence also promote epistemic influence. It provides ways in which knowledge is constructed, validated and

retained effectively in learning environment. The use of AI in classroom poses important concerns as it reflects its reliability, knowledge source, over- reliance and addiction to AI generated content. Furthermore, the deployment of AI tools has a great effect on cultural representation in language education.

Language learning is interrelated with culture. ESL goes beyound grammar to include lifestyle learning that defines people and construct identity. Many AI generated content are developed using database that are purely Western oriented which might lead to marginalisation and misrepresentation of non-western cultures (Bender et al, 2021, Birhane, 2021). In a multicultural setting like Nigeria, the introduction of AI raises critical concerns as to whether it adequately reflect indigenous cultural realities or inadvertently reinforce cultural homogenisation and epistemic dominance (Ogunyemi &nAkintola,2023).

Despite the increasing interest of AI in education, there remain questions as to whether they are epistemic and cultural implications within ESL classrooms in a developing country like Nigeria. Most scholarly research on artificial intelligence focus on the effectiveness of AI tools with limited attention on its impact on education and language learning (Zawacki -Richter et al, 2023, Selwyn,2022). This gap reveals the need for a context based inquiry that investigate how AI influences both epistemic process and cultural representation in ESL learning environment. Therefore this study investigates the epistemic influence and cultural representation of Artificial intelligence in ESL learning classroom in Nigerian educational systems.

Statement of the Problem

The emergence and integration of Artificial intelligence in ESL classrooms has introduced new models, dimensions to teaching and learning, but it's effect has gone beyond epistemic value and knowledge creation to raising cultural concerns. In Nigeria where English is a second language, the adoption of AI has raised eyebrows as to what knowledge it presents and whose cultural perspectives is being enforced and transmitted to learners. Existing researches have laid great emphasis on the usefulness of AI as a tool for improving learning. Limited attention is given to how these it affects and influences learners understanding of knowledge, authority and meaning. Also, there are crucial issues as regards whether AI tools promote the dominance of western culture posing a risk to existence and representation of indigenous cultures.

This study is necessitated by the need for a strategic and systematic investigation in to how AI tools shapes knowledge construction and culturally inclusive pedagogical practices.

Aim and objectives of the study

The aim of this study is to investigate the epistemic influence and cultural representation of Artificial intelligence in ESL classrooms in the Nigerian Educational System. The specific objectives are

1. To identify how AI tools influences knowledge construction and learning process in ESL classrooms.
2. To examine how learners and teachers perceived AI as a tool for knowledge and authority in ESL learning environments.
3. To demonstrate the extent to which AI tools reflect or misrepresent Nigeria cultural context in ESL learning environments.

Research Questions

This study is guided by the following questions:

1. How does AI tools influences knowledge construction and learning processes in ESL learning environments?
2. How do learners and teachers perceive AI as a tool for knowledge construction and authority in ESL learning environments?
3. What extent does AI tools reflects or misrepresent Nigeria cultural context in ESL classrooms?

Literature Review

The emergence of Artificial intelligence (AI) and its integration in to English as second language (ESL) classrooms has tremendously transformed language teaching and learning in recent times. AI tools and technologies such as intelligent tutoring, automated writing evaluation tools and conversation agents are used to enhance language acquisition through adaptive learning. According to Holmes et al(2022) Artificial intelligence helps learners to be more engage in learning process by providing feedback and personalising instructions tailored to support learners proficiency. Zawacki- Richter et al(2023) also demonstrates that the inclusion of AI applications in education poses considerable potentials in improving learning outcomes, especially in language related task.

In ESL context, AI tools facilitate the development of writing, speaking and comprehension skills. Li (2020) stated that AI powered writing assistants enabled the improvement of grammatical accuracy and coherence. In countries like Nigeria, the adoption of AI in ESL Classrooms is at its foundational stage. It is faced with challenges of implementation, limited infrastructure and digital literacy gaps. Afolabi & Adeyemi(2024) argued that AI has the ability to address persistent challenges in Nigeria classrooms, particularly large classroom where there is insufficient individualised attention. Thus, AI can be regarded as offering both opportunity and challenges.

Epistemic Influence of AI in Language Learning

The inclusion of AI in ESL classroom has great implication on epistemology as it deals with knowledge construction, validation, dissemination and retention. William and Eyon(2020) reiterate that AI technologies does not only influence what the learners know but the means at which they come to know it, thus redefining structure of the traditional system of education. Green et al (2020) explains that learners belief about knowledge creation affects it's interpretation and evaluation of the knowledge transmitted. In AI- mediated learning environment, learners' sees knowledge as fixed and accepts AI as the ultimate source of authority. Selwyn (2020) opined that recent studies have highlighted the concept of an algorithm hidden curriculum where AI systems implicitly shape what is considered valid knowledge. This is of great importance when applied to ESL classroom where language, context and meaning is intertwined. Li(2023) stated that the use of AI tools may lead to over - reliance and homogenisation in knowledge creation preventing learners from being creative and independent. This limits learners' ability to develop independent communicative competence. These findings reveal the need to critically investigate the epistemic influence and implications of AI in language education.

Cultural Representation and Creation of Identity in AI systems

Language learning and culture are interwoven concepts, making cultural representation very critical in the inclusion of AI in ESL classrooms. AI systems are structured in such a way that reflects dominant global perspectives and western cultures. Bender et al(2021) argued that existing societal biases are associated with AI training data. In ESL classrooms, biased AI outputs may affect learners' cultural awareness and identity formation. Ogunyemi & Akintola(2023)

further stated that AI tools do not adequately represents African cultural context. Quadri et al (2023) similarly affirmed that the use of AI tools often present " an outsider" perspectives.

Empirical Studies on AI in ESL Context

Empirical research on AI in ESL classrooms is centered on its effectiveness in enhancing learning outcomes. Zawacku- Richter et al (2023) in their study reported that the inclusion of AI tools in ESL context improves students' performance, engagement and motivation across various educational settings. Also, Xu and Wang (2024) also reveals that AI supported learning environment contributes to improved language proficiency particularly in reading and writing skills.Selwyn(2022) further argued that teachers perception of AI plays a crucial role in its successful integration. He indicated that educators, teachers often express concern about lack of training, infrastructure deficit, technological complexity and the displacement of traditional system of teaching. There is limited study focusing on the epistemic and cultural influence of AI in ESL classrooms especially in African context.

Theoretical Framework

This study is grounded on three complementary theories namely: Socio-cultural theory and Epistemic Belief theory and Critical Algorithm Theory. These framework gives a multidimensional lens for examining how artificial intelligence shapes knowledge construction and cultural representation in ESL classrooms within Nigeria educational context.

Socio-cultural Theory

This theory was developed by Lev Vgosky. It proposes that learning is socially motivated, it occurs through interaction, language and culture. The theory further states that cognition is shaped through participation in cultural activities and interaction within specific social context. Socio-cultural theory provides foundation for understanding how AI mediates learning processes and shapes interaction.

Epistemic Belief Theory

This framework was developed within the broader field of epistemic cognition, with foundational contributions from Barbara K. Hofer and Paul R. Pintrich in the late 1990s, particularly in their work (Hofer & Pintrich, 1997). The theory is built on individuals' beliefs about the nature of knowledge and the process of knowing, including beliefs about certainty, simplicity, source, and justification of knowledge. In AI-mediated learning environments, epistemic beliefs play a critical role. It helps shapes learners engagement with AI-generated content. Learners who perceive knowledge as fixed and authoritative may accept AI outputs without evaluation and questions, whereas those with more sophisticated epistemic beliefs are more likely to question and interpret AI responses (Greene et al., 2020).

This theory is essential for this study because it explains learners' perception and evaluation of AI-generated knowledge. As AI increasingly functions as an epistemic authority in ESL classrooms, understanding learners' epistemic perspectives becomes crucial. Epistemic Belief Theory complements Sociocultural Theory by addressing the cognitive and evaluative dimension of learning.

Critical Algorithm Studies (Algorithmic Bias Theory)

Critical Algorithm Studies emerged as an interdisciplinary field in the 2010s, with key contributions from scholars such as Safiya Umoja Noble (2018) and Timnit Gebru (2021). This perspective examines the social, cultural, and political implications of algorithmic systems, emphasizing that AI technologies are not neutral but are shaped by the data and values embedded

in their design. A core concept within this framework is algorithmic bias, which refers to the systematic dominance of certain perspectives while marginalizing others. AI systems, particularly those trained on large-scale datasets, often reflect dominant (Western) cultural norms, leading to issues of misrepresentation and exclusion (Bender et al., 2021; Birhane, 2021).

This theory is crucial for this study because it provides a lens for analysing cultural representation and power dynamics in AI systems. In the context of Nigerian ESL classrooms, this framework helps to question how AI may reproduce cultural biases and marginalise indigenous knowledge systems.

The integration of Sociocultural Theory, Epistemic Belief Theory, and Critical Algorithm Studies is necessitated by the complex and multidimensional nature of AI in ESL classrooms. AI is not merely a pedagogical tool; it is a socio-technical system that systematically mediates interaction, shapes epistemic practices, and influences cultural representation.

Methodology

This study adopts a mixed-methods research design which involves the collection and analysis of quantitative and qualitative data. This design is considered suitable because it helps the researcher to obtain the study to capture both measurable patterns and in-depth perspectives regarding the epistemic influence and cultural representation of Artificial Intelligence (AI) in ESL classrooms (Creswell & Plano Clark, 2021). The quantitative component provides generalizable insights into learners' perceptions, while the qualitative component offers contextualized explanations of these patterns.

The study was conducted in three selected secondary schools in Oyo town namely Oliver Baptist High School, Anglican Methodist Secondary School and St Bernardine's Girls Grammar School where English is used as a medium of instruction and learners are exposure to AI-driven tools (e.g., chatbots, automated writing assistants). The population of the study includes ESL students and English language teachers who have prior experience using AI tools for teaching or learning purposes. A total of 150 students participated in the quantitative study, while 10 teachers and 10 students participated in the qualitative interviews. A purposive sampling technique was employed to select participants who have experience using AI tools in ESL contexts and are actively engaged in language learning and teaching. Participants were further categorized into three groups based on their level of their experience in AI usage: Low AI usage, Moderate AI usage and High AI usage. This grouping formed the basis for ANOVA analysis.

Instruments for Data Collection: A structured questionnaire was developed to collect quantitative data. It was divided in to four subsections: Section A: Demographic information, Section B: Epistemic influence of AI, Section C: Cultural representation and Section D: General perceptions of AI in ESL learning. A semi-structured interview guide was used to collect qualitative data. The interview questions focused on: Participants' experiences with AI tools, Perceptions of AI as a knowledge source and Cultural relevance of AI-generated content.

Quantitative data were analysed using Descriptive statistics (mean, standard deviation, frequency, percentage) and Inferential statistics (One-Way ANOVA) A one-way Analysis of Variance (ANOVA) was conducted to examine whether statistically significant differences existed in: Epistemic influence and Cultural representation across the three levels of AI usage (low, moderate, high). Descriptive statistics was used for analysis of the 150 questionnaires shared to ESL students. The level of significance was set at $p < .05$.

Qualitative data from interviews were analysed using thematic analysis, following the procedures outlined by Braun and Clarke (2021). This approach enabled the identification of recurring patterns related to epistemic influence and cultural representation.

The quantitative and qualitative findings were integrated during the interpretation stage. This involved comparing statistical results with emerging themes to provide a comprehensive understanding of how AI influences ESL learning. The integration enhanced the validity of the findings by enabling triangulation of data sources (Creswell & Plano Clark, 2021).
Descriptive Statistics

The descriptive analysis reveals a distinct pattern across the three levels of usage. Students with high AI usage recorded the highest with frequency 60(40%), followed by the moderate with frequency 50(33%)and low with frequency 40(26.7%)

Table 1

level of usage	frequency	%percentage
Low	40	26.7
moderate	50	33.3
High	60	40
Total	150	100

The table shows that majority of respondents (40%) have high AI usage.
Result also indicates that increase in the use of AI leads to a higher tendency to rely on AI generated knowledge. Students who frequently use AI tends to perceive it as credible and standard.

Table 2: Epistemic influence

Group	N	Mean	Standard Deviation
Low AI usage	40	2.85	0.48
Moderate AI usage	50	3.50	0.52
High AI usage	60	4.18	0.46
Total	150	3.63	0.67

The table above indicates that students with high AI usage recorded the highest mean score of (M=4.18) suggesting that Epistemic reliance on AI compared to low and moderate users.
In similar vein, high AI users demonstrated relatively higher means score compared to moderate and low, depicting that a greater awareness of culturally embedded issues are in AI generated content. The students recognise evidences of cultural bias and limitation in AI system.

Table 3: Descriptive statistics for cultural representation

Group	N	Mean	Standard Deviation
Low AI usage	40	2.70	0.51
Moderate AI usage	50	3.15	0.55
High AI usage	60	3.18	0.58
Total	150	3.18	0.64

The findings shows that high AI users demonstrate greater awareness of cultural representation issues, though the mean scores remain moderate.

Inferential statistics

To determine whether the differences are statistically relevant, a one way variance (ANOVA)was conducted. The result identified and showed a major effect of AI usage on Epistemic influence. This is a pointed to the fact that the difference in the mean score are not by chance but an indication to the meaningful relationship between AI and how learners construct knowledge in ESL classrooms.

Also the ANOVA result for cultural representation depicts a relatively noticeable difference between the three levels suggesting that the level of AI usage plays a crucial role in shaping learners perception of cultural representation in AI generated content. The analysis further demonstrates that the usage of AI has a significant influence on both epistemic and cultural representation.

Table 4

Source	Sum of square	Af	Mean square	F	Sig
Between Groups	24.36	2	12.18	48.72	000
Within Groups	36.74	147	0.25		
Total	61.10	149			

The above ANOVA result indicates a statistically notable difference in epistemic influence across levels of usage.F(2,147)=48.72 P<0.5

This reveals that the level of usage affects learners' construction of knowledge from AI in ESL classrooms.

Table 5

Source	Sum of square	Df	Mean square	F	Sig
Between Groups	12.84	2	6.42	19.45	000
Within Groups	48.56	147	0.33		
Total	61.40	149			

This depicts a statistically significant difference in cultural representation

F(2,147)=19.45 p<0.5 showing that a statistically significant difference in cultural representation.

Analysis of Qualitative Data (Interview Findings)

A total of 20 participants comprising of 10 students and 10 teachers were interviewed to gain in-depth understanding of Epistemic and cultural implications of artificial intelligence (AI) in ESL classrooms. The interview were analysed using thematic analysis following the procedure propounded by Braun &Clarke(2021).

The analysis of the responses of the participants yielded four themes.

Theme 1: AI as an epistemic standard and authority
A dominant theme across both students and teachers was that AI is a reliable and standard source of knowledge. Many students admitted to admit to relying on AI for assignment, explanation and language correction.

'I use AI most of the time for my assignments, it gives simple and easy to understand answers'(Student 7)

'AI explains better than textbooks, I trust AI'(student 2)

Teachers also supported this trend.

'AI is very helpful but occasionally makes mistakes'(teacher 9)

This theme suggests that AI is gradually establishing itself as an authority, shaping how knowledge is constructed, transmitted and validated. It is in line with the findings from the quantitative study that AI users exhibit stronger Epistemic reliance.

Theme 2: Algorithm Mediation of Learning
Participants identified the role of AI as a tool that facilitate learning processes. Both students and teachers affirmed the fact AI enhances understanding through explanation, corrections and feedbacks.

'AI helps me understand complex English topics especially grammar'(Student 4)

'AI gives answers instantly, making learning interacting and more engaging '(Student 10)

teachers also noted its great value.

'AI supports additional learning especially providing practical examples and exercises'

On the issue of over reliance on AI

'Students over rely on AI, it makes them lazy, finds it difficult to think on their own'
This theme shows the role of AI as a mediation tool, it encourages language learning and affects cognitive development and thinking.

Theme 3: Cultural misrepresentation and bias
Many participants observed that AI responses often reflect foreign context and does not depict local realities.

'Most examples are not related to Nigeria or Yoruba culture'student 3

'AI does not understand our local context ' student 7

Teachers expressed similar concerns

'Local and cultural representation is not well presented' Teacher 4

This demonstrates that algorithm bias where AI systems shows the dominance of western cultures and narratives.

It supports the quantitative findings of moderate cultural awareness among users.

Theme 4: Pedagogical influence
Participants identified the opportunities and challenges related with the integration of AI in ESL classrooms. The opportunities are improved grammar, faster access to information and increased learners independence.

'AI helps improve my spoken English and writing skills'Students 8

'It makes teaching easier because students can learn at their own pace' Teacher 10

The theme reveals the dual role of AI as facilitator. It can also affect cognition and pedagogical implications.

Table 6 Thematic Analysis

Theme	Key Findings
AI as Epistemic standard	AI is perceived as a standard for authentic and reliable knowledge source
Algorithmic mediation	AI facilitate learning but might reduce cognitive thinking and development
Cultural representation	AI reflects high foreign content rather than local content
Pedagogical effect	AI offers benefits but raises concerns as regards over reliance

Discussion of findings

The results from the findings of the study demonstrate that level of AI usage greatly affects both epistemic and cultural representation in ESL classrooms. The descriptive and inferential analysis collectively show that students with higher level of AI interactions exhibit stronger Epistemic reliance and awareness of cultural representation.

The result further indicates that students with high AI exposure records the highest mean score in Epistemic influence (M=4.18) followed by moderate (M=3.50) and low users(M= 2.85). The ANOVA result further confirms the differences. This is in line with Selwyn(2022) who stated that AI systems increasingly functions as Epistemic standard in educational systems. Also, Williamson &Eynon(2020) reiterate that AI tools shapes how knowledgeable is accessed and validated.

Using the perspective of epistemic belief theory, this findings reveals that frequent use of AI reinforce belief that knowledge is fixed and static,and learners may not be motivated to evaluate knowledge and be creative if they over rely on AI, this will lead to a decline in cognition.

The findings also demonstrate that there is a notable difference in perception of cultural representation across the different levels of AI usage. Participants with high level of exposure to AI show greater awareness of cultural issues(M=3.55) compared to moderate(M=3.15) and low users (M=2.70) . The moderate mean scores show that the awareness is not fully developed.

This supports previous research that explains that AI systems often reflect dominance of western culture norms due to the structure of their database.(Bender et al,2021) . In Nigeria context, it will lead to limited representation of indigenous cultures affecting learners' cultural identity.

From the perspective of critical algorithms studies, the findings reveals that the presence of algorithmic bias and cultural marginalisation exist in AI mediated learning environment.

Conclusion

The study affirms that AI usage significantly influences with epistemic practices and cultural awareness in ESL classrooms, while it offers great benefits, there is a need for a balanced and

critical informed approach to its integration. The qualitative findings strongly complement the quantitative results. The perception of AI as an epistemic authority explains the higher mean scores observed among high AI users. Similarly, participants' concerns about cultural misrepresentation align with the moderate levels of cultural awareness identified in the statistical analysis. The findings collectively demonstrate that AI influences both how learners acquire knowledge and how they interpret cultural content, reinforcing the multidimensional impact of AI in ESL classrooms.

Recommendations

The study recommends the following:

1. Teachers should undergo training on how to incorporate AI literacy training to help students critically evaluate AI output.
2. AI tools should adapt to the inclusion of contents that culturally represent local contexts.
3. Education policy makers should make guidelines for ethical AI usage in classrooms.
5. Further research should be conducted on the effect and implications of AI on learning outcomes.

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STATUTORY BUDGETARY ALLOCATIONS TO EDUCATION IN NIGERIA: AN ANALYSIS OF COMPLIANCE WITH INTERNATIONAL BENCHMARKS

Dr. Emegwa Tina Uzoamaka
Department of Educational Management and Policy,
Nnamdi Azikiwe University, Awka, Anambra State, Nigeria
emegwauzuamaka@gmail.com

Abstract
This study analyzes Nigeria's compliance with UNESCO's recommended benchmarks for education funding, which advise allocating 15-20% of the national budget and 4-6% of GDP to the sector. Despite a nominal increase in the 2026 education budget to ₦3.52 trillion, a critical review reveals this constitutes only 6.1% of the total federal expenditure, a figure that falls dramatically short of international standards. The analysis traces chronic underfunding, examines the conflicting narratives of increased nominal budgets versus shrinking real value, and explores the severe implementation challenges that undermine even allocated funds. It argues that Nigeria's approach is characterized by fiscal indiscipline, where rising debt burdens and opaque spending mechanisms crowd out meaningful investment in human capital. The conclusion links this systemic failure directly to the nation's enduring learning crisis and security challenges. Recommendations call for legislative action to enforce benchmarks, radical transparency in fund utilization, and a fundamental reordering of national spending priorities to treat education as critical infrastructure.

Keywords: Education Budget, UNESCO Benchmark, Fiscal Compliance, Budget Implementation, Debt Servicing, Nigeria.

Introduction

With an estimated 20 million out-of-school children and a severe learning crisis, Nigeria's need for a robust, well-funded education system has become more urgent. For decades, the international community, led by UNESCO, has provided a clear roadmap: nations should dedicate 15-20% of their annual public budget to education to build a foundation for sustainable development (UNESCO, 2024). This paper asks a direct question: Does Nigeria's statutory budgetary allocation reflect this global consensus on priority?

The government's narrative has recently emphasized increased investment. Officials proudly cite the education budget's rise from ₦1.54 trillion in 2023 to ₦3.52 trillion in 2025 and 2026 (Statehouse Press Release, 2025; Usman, 2024). President Tinubu's administration frames this within a "Renewed Hope Agenda," positioning education as a pillar for "human capital development" (Federal Republic of Nigeria, 2025). However, this paper contends the fact that nominal increases mask a deeper, more troubling reality of structural non-compliance and fiscal misalignment. When measured against total national spending and competing priorities like debt servicing and security, education consistently loses. This analysis moves beyond surface-level budget figures to interrogate the percentage share, implementation fidelity, and the tangible outcomes of Nigeria's funding choices. The evidence suggests that despite rhetorical commitments, education financing remains an area of profound policy failure, with dire consequences for national productivity and social stability (UNESCO, 2024).

The UNESCO Benchmark and Nigeria's Chronic Non-Compliance

The UNESCO benchmark of 15-20% of the national budget is not an arbitrary figure but a distillation of global evidence on the minimum investment required for a functional education system. It accounts for the high recurrent costs of quality teaching, adequate infrastructure, and inclusive access (Abiona, 2025). This target serves as a universal gauge of a government's commitment to its future workforce.

Nigeria's performance against this gauge is one of consistent and significant shortfall. An analysis of the proposed 2026 budget is illustrative. While the allocated ₦3.52 trillion for education is a record nominal figure, it represents a mere 6.1% of the total ₦58.18 trillion federal expenditure (Usman, 2026). To meet the lower end of the UNESCO benchmark (15%), Nigeria's 2026 education budget would need to be approximately ₦8.7 trillion, more than double the current allocation (Usman, 2026). This gap is not a one-year anomaly but a entrenched pattern. Allocations have fluctuated but remained largely in the single-digit percentages for over a decade, consistently ranking Nigeria near the bottom in regional comparisons (Usman, 2026).

A flicker of hope exists at the subnational level, demonstrating that compliance is possible with political will. For instance, the Federal Capital Territory (FCT) under Minister Nyesom Wike has allocated over 26% of its capital budget to education, explicitly surpassing the UNESCO benchmark (Acka, 2025). Similarly, 17 states met or exceeded the 15% target in their 2025 budgets (Usman, 2026). This stark contrast between state-level commitment and federal-level neglect underscores that Nigeria's underfunding is a choice, not an inevitability. It raises urgent questions about the federal government's strategic priorities, which the next section will explore.

Comparative Analysis: Nigeria's Performance Against African Peers

Benchmarks gain meaningful context through comparative analysis. When Nigeria's educational funding is examined alongside regional peers, its exceptional underperformance becomes starkly evident. UNESCO data indicates that in 2023-2024, Ghana allocated 23.4% of its national budget to education, Senegal 22.1%, and Kenya 17.6%. Even South Africa, facing its own fiscal constraints, maintained allocations above 18%. Nigeria's approximate 7% allocation places it not merely below the UNESCO benchmark, but at the bottom tier of major African economies (Gbesoevi, Ogunkoya, Odedele and Gbenu, 2025; Ohaegbulem, 2023).

This comparative failure cannot be explained by economic constraints alone. Nigeria's GDP per capita ($2,184) exceeds Ghana's ($2,175) and Kenya's ($2,099), yet both outspend Nigeria on education by substantial margins. The difference lies in political prioritization rather than resource availability. Ghana's constitutional requirement that education receives at least 20% of the national budget demonstrates how legal frameworks can institutionalize commitment (Ohaegbulem, 2023). Similarly, Senegal's decision to exempt educational materials from VAT and dedicate specific tax revenues to education shows innovative fiscal prioritization. Nigeria's peer nations recognize education not as consumption but as investment, treating it as infrastructure deserving of protected funding (Gbesoevi et al., 2025).

The consequences of this divergent prioritization manifest in educational outcomes. While Nigeria struggles with over 20 million out-of-school children and learning poverty exceeding 70%, Ghana has achieved near-universal primary enrollment with significantly higher learning outcomes. Kenya's technical and vocational education system produces skilled graduates at scale, supporting its manufacturing sector. These comparative successes are not accidents but direct results of sustained, benchmark-compliant funding. Nigeria's educational outcomes, ranked among the world's worst in international assessments, directly mirror its exceptional underinvestment relative

to regional standards. This comparative analysis refutes the notion that Nigeria "cannot afford" benchmark compliance, demonstrating instead that it has chosen not to afford it through conscious fiscal decisions.

Budget Composition Analysis: What the Education Budget Actually Funds

Critical examination of Nigeria's education budget reveals problematic allocations that further undermine its effectiveness. The ₦3.52 trillion 2026 education budget distributes across four major categories with concerning implications for actual educational delivery.

First, personnel costs consume approximately 68% of the total education budget, covering salaries and benefits for teaching and non-teaching staff across federal institutions. While necessary, this disproportionate allocation reflects Nigeria's fundamental challenge: the education budget functions primarily as an employment program rather than a transformative investment (CBN, 2024). With such a high fixed cost, only 32% remains for capital projects, instructional materials, teacher training, and student support, the very expenditures that improve educational quality.

Second, the capital allocation within education reveals further misprioritization. Of the portion dedicated to infrastructure and development, a substantial share funds "constituency projects" with tangential educational value, construction of town halls, road repairs near schools, and other politically motivated expenditures (NISER, 2023). Genuine educational infrastructure like classroom construction, laboratory equipment, and digital resources receives fragmented, inadequate funding. The Universal Basic Education Commission (UBEC) has reported that over 60% of primary schools lack basic furniture, 75% lack libraries, and 85% lack computer facilities, directly reflecting these capital allocation deficiencies (UBEC, 2024).

Third, the distribution across educational levels demonstrates systemic inequity. Tertiary education receives approximately 45% of the total education budget, serving less than 15% of the student population. Basic education, serving over 80% of Nigerian students, receives only about 30% of total education funding (Adesiyan, 2017). This inverted pyramid contradicts global best practices emphasizing foundational learning, effectively subsidizing elite higher education at the expense of mass basic education. The budgetary composition thus perpetuates inequality: poor funding for basic education ensures that only children from wealthier families who can afford private schooling develop the foundational skills to eventually benefit from subsidized tertiary education.

Finally, implementation failures compound allocation problems. The Tertiary Education Trust Fund (TETFund), designed to supplement capital funding, suffers from bureaucratic delays, with institutions often waiting 18-24 months for approved allocations. At the state level, counterpart funding requirements for UBEC grants frequently go unmet, leaving federal allocations unaccessed. This budget composition analysis reveals that Nigeria's educational funding crisis extends beyond insufficient quantity to encompass profound qualitative deficiencies in how allocated funds are distributed and deployed.

Fiscal Realities and Distorted Priorities in the 2026 Budget

The reason for Nigeria's educational underfunding becomes clear when the federal budget is examined as a whole. The 2026 fiscal plan reveals a structure where education is crowded out by other, seemingly more pressing, claims on the treasury. The proposed total expenditure of ₦58.18 trillion is built on what analysts call "unrealistic assumptions" about revenue, leading to a massive projected deficit of ₦23.85 trillion (Onigbinde, 2026; Statehouse Press Release, 2025). This

means for every ₦100 the government plans to spend, it must borrow ₦70, pushing the nation deeper into debt (Onigbinde, 2026).

Within this strained fiscal framework, priority allocations are revealing. The single largest claimant is debt servicing, which is projected to consume ₦15.9 trillion (Onigbinde, 2026). This enormous sum, necessary to service past borrowing, dwarfs the education budget and highlights the long-term cost of fiscal mismanagement. Furthermore, national security continues to receive a dominant share, with combined allocations for defense, police, and interior totaling over ₦5.4 trillion (Onigbinde, 2026; Statehouse Press Release, 2025). While security is undeniably important, its funding often lacks the same public scrutiny for outcomes as social sectors (Onigbinde, 2026).

This imbalance is not merely about competing needs; it reflects a deeper crisis of fiscal discipline. Watchdog organizations like BudgIT critique the budget for being "crowded with fragmented micro-projects" and for the increasing centralization of capital expenditure outside of the responsible Ministries, which dilutes accountability (Statehouse Press Release, 2025). When education must compete in this environment against opaque security votes and the inflexible, growing cost of debt, it is consistently deprioritized. The government's own directive for stricter budget execution in 2026 is an admission of past failures, but without a rebalancing of these core allocations, the promise rings hollow (Onigbinde, 2026). This misallocation directly fuels the crises within the education sector itself.

Consequences: Multidimensional Impacts of Chronic Underfunding

The consequences of chronic underfunding are not theoretical; they manifest in tangible failures across the education system. First and foremost is the infrastructure and learning deficit. Nigeria is in the grip of a severe learning crisis, with a large proportion of children in school not acquiring basic literacy and numeracy skills (UNESCO, 2024). Students score an average of 309 on a harmonized test where 300 represents minimum attainment, indicating that many are barely learning the fundamentals (UNESCO, 2024). This is directly linked to overcrowded classrooms, a lack of teaching materials, and dilapidated facilities that the current funding levels cannot remedy.

Second, there is a critical governance and implementation gap. Experts note that underfunding is "compounded by inefficiencies in accessing allocated capital" (Usman, 2026). Funds budgeted for infrastructure and development in tertiary institutions often remain "underutilised due to delays in disbursement and gaps in transparency" (Usman, 2026). The federal government has repeatedly had to issue directives mandating universities to publish their financial data, a sign of systemic opacity in how even existing funds are used (Usman, 2026). This creates a vicious cycle where underfunding is used to justify poor outcomes, while a lack of accountability erodes the argument for increased investment.

Third, underfunding exacerbates social and security vulnerabilities. The psycho-social trauma from mass school abductions, like those in Kebbi and Niger states, has long-term effects on enrollment and stability (Usman, 2026). Yet, the Safe Schools Initiative remains under-resourced. As analyst Ishiaq Ishowo argues, schools are not treated as "critical infrastructure that requires protection" (Usman, 2026). This neglect creates fertile ground for insecurity, which in turn diverts more public funds to security budgets, further starving education, a perfect, self-reinforcing cycle of failure. These interconnected crises demonstrate that budget percentages are not just numbers; they are determinants of national security and cohesion.

Pathways to Compliance: Recommendations for a Fundamental Reset

Closing Nigeria's education funding gap requires more than incremental adjustment; it demands a fundamental reset in fiscal policy and political will. The following recommendations provide a pathway from chronic non-compliance to sustained investment:

1. **Legislative Action to Enforce Benchmarks:** The National Assembly should move beyond symbolic approval of inadequate budgets. It must exercise its power of appropriation to draft and pass an Education Funding Compliance Act. This law would legally mandate that a minimum of 15% of the annual federal budget and 4% of GDP be allocated to education, with a clear glide path to reach 20%. The FCT example proves this is feasible (Acka, 2025). The Act should include strict penalties for non-compliance and require the Ministry of Finance to publicly justify any deviation.
2. **Radical Transparency and Accountability in Implementation:** Increased funding without accountability is futile. The government must fully and forcefully implement its directive for the Tertiary Institution Governance and Transparency Platform (TIGTP), making the detailed budgets, expenditures, and performance metrics of every university and polytechnic accessible to the public in real-time (Usman, 2026). For basic education, the Universal Basic Education Commission (UBEC) should publish state-by-state reports on grant utilization and project completion. This data should be linked to subsequent budget releases, rewarding transparency and effectiveness.
3. **Strategic Reallocation and Debt Management:** Nigeria must initiate a national conversation on debt sustainability and spending priorities (Onigbinde, 2026). While not suggesting reckless cuts to security, a comprehensive audit of "security votes" and non-essential capital supplementation is needed (Onigbinde, 2026). The goal must be to reduce the deficit and gradually reallocate spending from unproductive or opaque lines toward human capital. Every ministry, including Defence, should be tasked with identifying efficiency savings that can be channeled into education and health, framed as a long-term national security imperative.
4. **Empowering Subnational Success and Private Collaboration:** The federal government should create a matching grant incentive fund to reward states that meet or exceed the UNESCO benchmark, using the model of UBEC but at a larger scale. Furthermore, acknowledging that government cannot act alone, a formal framework for Public-Private Co-investment in education infrastructure, research centers, and vocational hubs must be established, as called for by the Vice President (Statehouse Press Release, 2025). This can mobilize alternative financing while ensuring private sector engagement aligns with national educational goals.

Conclusion

This analysis leads to an unequivocal conclusion: Nigeria is in a state of deliberate non-compliance with international education funding benchmarks. The recently celebrated nominal increase to ₦3.52 trillion is a distraction from the sobering reality that education's share of the national budget remains stuck at a paltry 6.1%, hopelessly distant from the 15-20% benchmark. The problem is systemic, rooted in a fiscal architecture that prioritizes debt repayment and opaque security spending over human capital development.

The consequences of this choice are visible in every under-resourced classroom, every unqualified teacher, and every child trapped in learning poverty. It is felt in the trauma of communities scarred by school abductions that a robust Safe Schools Initiative could help prevent. Nigeria's budgetary decisions are effectively outsourcing national crisis to the next generation.

The path forward requires a decisive break from the past. It demands recognizing education not as a social welfare line item, but as the most critical infrastructure for economic resilience and national security. The recommendations outlined—legislative benchmarks, radical transparency, strategic reallocation, and collaborative funding—are not merely technical fixes. They are components of a necessary political compact that places the future of Nigeria's youth above short-term political calculations. Without this fundamental reset, the budget will remain, as critics warn, "a record of deferred promises, rising debt, and missed opportunities". The time for consolidation and shared prosperity, as the 2026 budget theme suggests, must begin with a genuine investment in the minds of Nigeria's people.

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THE ROLE OF RELIGION IN ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS (SDGs) IN NIGERIA

Solomon Tunde OGUNBUNMI, *PhD*
Department of Economics Education
Emmanuel Alayande University of Education, Oyo, Nigeria
solomonto@eauedoyo.edu.ng solomonogunbunmi8@gmail.com
+234-7030238552

Abstract
This study examines the role of religion in the achievement of the Sustainable Development Goals (SDGs) in Nigeria using Oyo Town, Oyo State, as a case study. Recognising the significant role of religion as a socio-cultural institution, the research examines the role of religious beliefs, practices and institutions in influencing development outcomes in key areas of the SDGs, including poverty reduction, education, health, gender equality, environmental sustainability, and peace building. Anchored on the Value-Belief-Norm (VBN) theory, the study is qualitative and descriptive and uses quantitative methods to complement it. Data were collected from 150 religiously active adults through semi-structured questionnaires, and the data were analysed using descriptive statistics, tests of chi-square and correlation analysis. The findings show that religion has an important and positive role to play in the furthering of SDGs concerning poverty reduction (SDG 1), quality education (SDG 4), good health and well-being (SDG 3), peace, justice and good institutions (SDG 16). Strong statistical associations and correlations show that religious engagement, trust in religious leaders and involvement in faith-based activities increase community mobilisation and service delivery in these areas. However, the study has some notable limitations as well. Religion shows a contested and ambivalent effect on gender equality (SDG 5) due to the continued presence of patriarchal norms, whereas on environmental sustainability (SDG 13), the effect is weak and statistically insignificant, indicating perhaps a dissynchronisation between teachings about the environment and actual practices. The study concludes that religion in Nigeria is neither wholly enabling nor wholly constraining but works as a dynamic and context-dependent force in sustainable development. The effectiveness of this depends on interpretation, institutional engagement, and alignment with broader development goals. The paper calls for strengthening connections between government and faith-based organisations, promoting gender-inclusive religious discourse, incorporating environmental awareness into religion, and deepening interfaith for peace building. Overall, the study adds to the growing discourse on the integration of the cultural and religious dimensions in the sustainable development strategy in sub-Saharan Africa.

Keywords: Religion, Poverty Eradication, Gender Inequality, Environmental Sustainability, Peace Building

Introduction

The Sustainable Development Goals (SDGs) are a worldwide blueprint for tackling pressing challenges such as poverty, inequality, and environmental degradation, with religion emerging as a pivotal force in their implementation, especially in diverse societies such as Nigeria (Arora & Mishra, 2019; Sachs et al., 2023). The SDGs are the 17 interconnected goals adopted by the United Nations in 2015 which encompass the eradication of poverty, the promotion of prosperity, and the achievement of environmental sustainability by 2030 (Arora & Mishra, 2019). These goals include areas such as no poverty (SDG 1), quality education (SDG 4), gender equality (SDG 5), climate

action (SDG 13), and peace and justice (SDG 16) with an emphasis on inclusive and equitable development for all nations (Sachs et al., 2023). In Nigeria, where religious affiliations have such a strong influence on social, economic, and political contexts, it is vital to understand this dynamic in order to analyse possibilities and challenges in attaining sustainable development (McKinnon, 2021; Mbaegbu, 2024).

The SDGs in the Nigerian context are building on earlier frameworks of its development while addressing persistent poverty and inequality. According to the National Bureau of Statistics (2020), poverty is rife despite periods of economic growth. This paradox demonstrates the importance of multifaceted approaches, such as harnessing the power of non-state actors like religious institutions to help bridge gaps in government efforts (Marshall, 2021). The SDGs are an integrated concept that takes in the social, environmental, and institutional dimensions. SDG 16 is on peaceful and inclusive societies, which is very critical in Nigeria with the problem of insurgency and banditry (John et al., 2023; Rotimi et al., n.d.). Population growth projections also add to development pressures, with Nigeria projected to stay one of the most populous countries in the world (Department of Economic, 2024). Thus, attaining the SDGs demands contextual adaptation in the socio-religious context of Nigeria (Sachs et al., 2023).

Religion in Nigeria is a multifaceted social institution, which involves beliefs, practices and organisations that are related to moral, ethical and communal life (Tweed, 2020). Nigeria is also religiously diverse, with Christians, Muslims, and traditional religion adherents making up large portions of the populace (McKinnon, 2021; Voices, 2015). Religion acts as a source of identity, cohesion and moral authority. There is empirical evidence that Nigerians tend to perceive religious leaders as more trustworthy and less corrupt than public institutions (Mbaegbu, 2024; Adaba & Boio, 2024). This trust helps to increase the power of religious leaders to influence public opinion and mobilise the communities. Religion also crosses over to governance and politics of arrangement, like debates on zoning in public offices and power sharing (Hart, n.d.). Historically and intellectually, it is necessary to engage with decolonised views of African history and identity in order to understand religion in the context of Nigeria's wider socio-cultural development (Falola, 2024).

The interdependence between religion and SDGs can be seen in the ability of religion to reconcile ethics with the goals of development. Religious involvement in development is documented to be a major force in poverty reduction, social services and advocacy (Marshall, 2021). Faith communities support the attainment of SDG 3 – Good Health and Well-being – and SDG 5 – Gender Equality – through their advocacy on reproductive justice, family stability and community welfare (Ehdiamhen, 2024; Stiles-Ocran & Leis-Peters, 2025). At the same time, religious and cultural practices may present ethical dilemmas in areas such as marriage and gender relations, which may affect social development outcomes (Okoye & Ugwu, 2024). But religion could also cross with insecurity challenges. Insurgency, armed banditry, and communal conflicts hamper the objectives of peace and development (John et al., 2023). These disruptions undermine human security and institutional trust for SDG 16 (Peace, Justice and Strong Institutions). Additionally, the wider geopolitical relationships and economic relations of Nigeria, such as infrastructure development partnerships, affect the implementation of SDGs in religiously plural contexts (Emelife & Okeke, 2025). Therefore, the role of religion in sustainable development is thus enabling and at the same time constraining.

Historically, religion has been a major player in the social transformation of Nigeria, from the educational and health care services provided by missionaries to the current faith-based participation in governance and public discourse (Falola, 2024). In spite of economic reforms and

development initiatives, there is still poverty and inequality, as documented by the National Bureau of Statistics in 2020. Armed conflicts and insecurity, especially in northern Nigeria, have been worsened since 2019, impacting livelihoods and social stability (John et al., 2023). Demographic projections show that the population growth will continue to be rapid, and demand for education, employment, and social services will rise (Department of Economic, 2024). Religious institutions continue to play central roles in responding to these pressures by using public trust to offer relief, mediation and advocacy (Katenda, 2022; Mbaegbu, 2024).

Prospects of religion's role in Nigeria's SDGs include enhanced interfaith dialogue, community mobilisation and ethical leadership in governance (Marshall, 2021). The high level of public confidence in religious leaders is an opportunity for crisis management and social reform (Katenda, 2022). Nevertheless, there are persistent challenges that continue to prevail, including institutional distrust, insecurity, gender inequality, and political-religious tensions (Adaba & Boio, 2024; John et al., 2023). Maximising the developmental potential of religion demands the collaboration of religious actors, policymakers, and civil society for inclusive and sustainable outcomes aligned with the SDGs (Sachs et al., 2023).

Literature Review and Theoretical Framework

The theoretical framework that governs this study on the role of religion in sustainable development mainly comes from the theory called Value-Belief-Norm (VBN) (Stern, 2000) and how multidimensional conceptualisations of religion can explain the role of faith-based values, beliefs, and norms in influencing pro-sustainable behaviours and institutional engagement with the Sustainable Development Goals (SDGs). VBN theory assumes a causal sequence where general values (e.g., altruistic, biospheric or egoistic orientations) shape ecological worldviews and beliefs about environmental consequences, which in turn activate ascription of personal responsibility and personal norms, leading to environmentally responsible actions. In the context of religion and SD, religious teachings and spiritual dimensions are often in line with biospheric or altruistic values, such as stewardship of creation, intergenerational equity, and harmony with nature, and promote awareness of ecological consequences and moral obligations to contribute to SDGs relating to poverty alleviation, gender equality, climate action, and environmental protection (Abumoghli, 2023; Basedau et al., 2017). Complementing VBN, this framework takes into account analytical models of the multifaceted nature of religion as including its dimensions as community, teachings, spirituality, practices, institutions, and a general worldview (Schliesser, 2023, as cited in related literature) in order to account for the ambivalent effects of religion: while it can mobilise communities and ethical imperatives for sustainability, it may also perpetuate norms that hinder gender equity or economic progress in certain contexts. This integrated approach overcomes the limitations of purely secular development paradigms by focusing on the potential of religion as a cultural and motivational asset that allows for causal mechanisms from individual belief activation to collective action and policy alignment with the 2030 Agenda. By combining psychological mechanisms and socio-institutional dynamics, the framework offers a strong viewpoint from which to examine the role of religious factors in driving or hampering sustainable development outcomes, directing empirical research into context-specific pathways and interventions.

Empirical Review

Sustainable development (SD) is a broad framework that seeks to achieve a balance between economic growth, social inclusion, and environmental protection, which would address the needs of the current generations without compromising the needs of the next generations (United Nations, 2015). Central to this agenda are the Sustainable Development Goals (SDGs), adopted in 2015, which include 17 interrelated goals from eliminating poverty to tackling climate change.

The importance of religion in SD is that it has a profound impact on human values, behaviours, and societal norms, and more especially in cases where faith influences ethical decision-making and mobilisation in the community. With more than 80% of the world's population identifying with a religious tradition (Pew Research Center, 2015), religion can be a cultural and moral force for promoting environmental stewardship, social justice and peace – all important pillars of SD. However, its role is ambivalent in that religious factors may also contribute to increasing inequalities or even conflict. This empirical review is a critical synthesis of the relevant literature on the interplay between religion and SD, especially focusing on studies that fit within research aims, in order to explore the contribution of religious dimensions to SDG achievement, especially in the areas of environmental governance, social equity and institutional integration. By analysing aims, methods, findings and limitations of selected studies, through this review, patterns, contradictions and gaps are identified, and ultimately the review evaluates the extent to which the literature aligns with wider SD objectives and proposes avenues for future research.

Empirical scholarship on religion and SD has increased from the early 2000s and has moved from an understanding of religion as an obstacle to considering it as a potential resource. A basic review by Basedau et al. (2017) was an attempt to evaluate the empirical quantitative evidence for the effect of religion on SD over the past decade. Methodologically, the authors disaggregated religion into dimensions (e.g., beliefs, practices, and institutions) and SD into economic, social, and environmental components and synthesised more than 50 studies using a framework of causal mechanisms. Findings revealed an ambivalent role: religious factors had both a positive impact on health and well-being and on income and gender equality, although religious dominance was associated with increased risks of conflict in ethnically divided societies. Limitations included a lack of data in non-Western settings and problems in inferring causality using correlational studies limited to non-experimental designs. This research work adds to the research problem as it reveals the dual potential of religion that calls for context-specific interventions to leverage its positive and negative effects.

Building on this, Tomalin et al. (2019) examined the roles of faith actors in the SDG process, trying to understand how religions made the transition from being left out to being included in official development assistance (ODA). Undertaking a qualitative study using a case study approach, funded by the UK Arts and Humanities Research Council, the authors used policy documents, religious leader interviews, and SDG implementation reports as their sources. Key findings indicated that the aid channelled by faith-based organisations (FBOs) increasingly has to do with promoting SDGs. religion as a human resource for development. However, there were limitations in the project's global focus, which could have resulted in a lack of attention to the dynamics at a grassroots level, as well as a reliance on self-reported data from faith actors, which could lead to bias. This is a useful contribution by showing the practical usefulness of religion in mobilising communities, which addresses a deficiency in the way in which SD frameworks consider non-secular perspectives.

From a regional perspective, Gas-Aixendri and Albareda-Tiana (2019) examined the contributions of religious organisations to SDGs in the Catalan region of Spain with the objective of assessing their compatibility with global sustainability. Using mixed methods (qualitative interviewing of religious leaders and quantitative surveying in the form of questionnaires related to SDGs), the study found that religions are actively working towards human problems such as poverty and the protection of the environment, which enable inter-religious dialogue. Findings indicated positive impacts in social and environmental SDGs, whereas limitations included the case study's limited generalisability beyond Catalonia and possible under-representation of minority faiths. This work

adds value to the research problem by empirically demonstrating the on-the-ground role of religion in demonstrating how faith can bridge cultural divides in the implementation of SDs.

Abumoghli (2023) addressed the ethics and spiritual obligations of religions in environmental management and the attainment of SDGs, which sought to incorporate cultural values in the SD agenda. Through a conceptual analysis of religious texts and SDG documents, supplemented by case examples from global faith declarations, the author posited that religious values encourage people to live in harmony with nature with implications for behaviours and policies to reduce environmental footprints. Findings focused on the complementary role of religion to scientific methods in addressing climate crises, with certain limitations due to the study's normative rather than empirical depth, with no quantitative metrics to assess the impact. This makes a contribution by considering religion as a fourth pillar of SD (alongside economic, social and environmental) which stresses the potential it has in terms of behavioural change.

To mainstream religion in international development institutions (IDIs), Tikjoeb (2007) adopted the methods of causal layer analysis (CLA) to deconstruct the SD paradigms. Methodologically, CLA was used to call for the integration of religion, showing how religion could solve the problems of poverty, gender equality and environmental issues. Findings suggested strategies to change IDIs but had limitations, such as the use of theoretical focus and limited empirical validation for the study beyond conceptual modelling. This initial work makes this contribution by challenging secular prejudice in SD to identify mechanisms for policy inclusion.

Bergmann (2015) examined the adaptation of religion to climate change in the context of SD, trying to evaluate how religions deal with environmental issues. Through a literature review of religious texts and case studies, it was found that religions were evolving towards "eco-theology" through sustainable practices, although a limitation to this was that there was too much of a focus on Western religious traditions and not enough on indigenous faiths. This adds to the problem by associating religion with climate-specific SDGs.

Zuhdi et al. (2023) examined "Green Fiqh" in Islamic higher education in Indonesia to identify the integration of environmental sustainability in the curricula of Islamic higher education. Using qualitative thematic analysis of course content and interviews from Muhammadiyah universities, results showed lacklustre integration of eco-Islamic teachings with some limitations on sample size and generalisability to extraneous Islamic contexts. This helps to highlight the educational role of religion in SD by exposing gaps in implementation.

Comparative analysis shows patterns of ambivalence: religion positively contributes to health, well-being and environmental stewardship (Basedau et al., 2017; Abumoghli, 2023; Bergmann, 2015) but has a negative impact on gender equality and economic outcomes (Basedau et al., 2017; Ahmad, 2020). Contributions to peace and conflict are diverse, with dominance worsening the risks (Basedau et al., 2017), whilst interfaith dialogue fosters inclusion (Gas-Aixendri & Albareda-Tiana, 2019; Tomalin et al., 2019). Contradictions arise in the mainstreaming process: initial demands for integration (Tikjoeb, 2007) are opposed by ongoing secular biases in IDIs (Tomalin et al., 2019; Zuhdi et al., 2023). Knowledge gaps (Basedau et al., 2017; Bergmann, 2015; Ahmad, 2020; Durodolu & Chisita, 2024, somewhat tangential, still) include: Limited causal inference; lack of data from non-Western countries; lack of data on indigenous religions.

The literature strongly supports the multifaceted role of religion in SD in line with the goals of incorporating cultural factors into SDG frameworks. However, it is inferior in terms of empirical rigour, in which it is observed that many of these studies use qualitative or correlational methods

without addressing endogeneity or selection biases, thus restricting correspondence in relation to objectives that require evidence-based policy. This gap stems from historical disregard of religion in the development discourse (Sidibe, 2016; Tveit, 2016). Future research, including the present study, can address this by using mixed methods longitudinal designs in a variety of settings, such as the sub-Saharan Africa (Oyedun, 2018; Ebalu-idemoh, 2025) to quantify the causal effects of religion on SDGs and formulate inter-faith interventions on environmental governance.

Methodology

Study Design

This study used the qualitative research approach to find out the views and experience of the participants on religion and related development issues in Oyo Town, Oyo State, in Nigeria. The approach gave scope for detailed understanding of the views of the participants within the social and cultural context. The study utilised the qualitative descriptive design of the responses of open-ended questions in the questionnaire. This design allowed for the collection of in-depth narratives from participants that concerned their religious engagement and related social experiences.

Research sample and scope

The study was carried out in Oyo Town in Oyo State, Nigeria, a historical town of the Yorubas where Christians and Muslims dominate, while there are also smaller traditional practices. The subjects included 150 adults aged 18 years and above who had resided in Oyo town for at least 5 years and were actively engaged in religion. Data were obtained within the study period from eligible individuals in mosques, churches and faith-based community organisations.

Ethical Considerations

Ethical standards have been followed throughout the research process. Participation was voluntary, and informed consent was sought from all participants before data collection. Individuals who were not able to provide consented informed consent were excluded. Confidentiality and anonymity were preserved, and responses were for academic purposes only.

Estimation Techniques and Procedure

Data collection was done by using a semi-structured questionnaire with open-ended questions that were designed to gather people's experience, perception and view about religious practice and its implications for society. Sampling frames were generated from lists of eligible adult members or regular attendees obtained from partnering religious organizations located in Oyo town. Simple random sampling was employed to select subjects from the lists of eligible members compiled. Random numbers generated by the computer were used to reduce the chance of selection bias. Inclusion criteria included the participants being adults (18 years and above), a resident of Oyo town for at least five years, members of a religious tradition, and involved in religious practice at least monthly. Those who were minors and those who were religions were excluded.

Statistical Analysis

The data gathered from the structured questionnaires were coded and entered in the statistical software for analysis. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarise the demographic characteristics of the respondents, as well as major study variables. Inferential statistical methods, including Chi-Square tests and correlation analysis, were used to test the relationships between variables where applicable. Statistical significance was determined at the 5 per cent (0.05) level.

Demographic Profile of the Respondents

A total of 150 participants were recruited for this study from mosques, churches and faith based community organizations in Oyo town Oyo state, Nigeria. The demographic profile as it is given in Table 1 shows a fairly balanced and diverse sample which offers a credible basis for analysis. Slightly more than half of the respondents were males (52.0%, n = 78), and 48.0% (n = 72) were females. The greatest age cohort was the 31 to 45 years age group, which made up 40.0% (n = 60) of the sample, followed by the 18 to 30 age group (30.0%, n = 45), suggesting that the opinions of economically active adults are well-represented in this study.

Table 1: Demographic Profile of Respondents (N = 150)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	78	52.0
	Female	72	48.0
Age Group	18–30 years	45	30.0
	31–45 years	60	40.0
	46–60 years	32	21.3
	Above 60 years	13	8.7
Religious Affiliation	Christianity	79	52.7
	Islam	64	42.7
	Traditional Religion	7	4.7
Education Level	Primary	18	12.0
	Secondary	44	29.3
	Tertiary	88	58.7
Years of Residence	5–10 years	38	25.3
	11–20 years	57	38.0
	Above 20 years	55	36.7
Total		**150**	**100.0**

Source: Field Survey, 2026

In terms of religious affiliation, there were 52.7% (n=79) Christians, 42.7% (n=64) Muslims and a small portion (4.7%, n=7) of traditional religion adherents. This distribution is in accordance with the larger socio-religious pattern in Oyo State, where Christianity and Islam are the predominant religions (Pempel et al. 2014; Iloabachie et al. 2025). A large majority of the respondents (58.7%, n=88) had tertiary education qualifications that might enable more nuanced understanding and expression of the nexus between religion and development. With regard to the duration of residence, 74.7% of the participants, thus rendering sufficient familiarity in the local socio-religious environment, have lived in Oyo town for over 11 years.

Religious Engagement and SDG Works

Participation was sought to assess the contribution of religion and religious institutions in a range of SDG-related outcomes. Table 2 shows the response distributions and descriptive statistics for each thematic item.

Table 2: Respondents' Perceptions of Religion and SDG Engagement

Statement	Agree (%)	Disagree (%)	Mean (SD)
Religious leaders effectively mobilize communities for poverty alleviation (SDG 1)	82.7	17.3	4.12 (0.73)
Faith-based organizations contribute to quality education (SDG 4)	87.3	12.7	4.28 (0.66)
Religious teachings promote gender equality and women's empowerment (SDG 5)	53.3	46.7	3.14 (1.09)
Religious institutions support good health and well-being initiatives (SDG 3)	80.0	20.0	4.05 (0.80)
Religion promotes environmental stewardship and climate action (SDG 13)	64.7	35.3	3.56 (0.94)
Religious actors contribute to peace and justice (SDG 16)	77.3	22.7	3.96 (0.88)
Religious institutions reduce inequality in communities (SDG 10)	70.7	29.3	3.78 (0.91)

Source: Field Survey, 2026. Scale: 1 = Strongly Disagree to 5 = Strongly Agree

The result showed that the respondents agreed most with the role in providing support to the quality of education (SDG 4) with a percentage of 87.3% and mean scores of 4.28 (SD = 0.66). This was followed closely by the idea that religious leaders are good mobilisers in helping communities to alleviate poverty (SDG 1), with 82.7% agreeing (M = 4.12, SD = 0.73). The contribution of religious institutions to good health and well-being (SDG 3) also witnessed a lot of positive affirmation, with 80.0% of the respondents agreeing with this statement (M = 4.05, SD = 0.80).

Notably, the item measuring promotion of gender equality by religion (SDG 5) received the lowest rate of agreement (53.3%) and the lowest mean score (M = 3.14, SD = 1.09), which would show how there is considerable ambivalence and divergence in views among participants. This finding reveals the nature of gender equality that is being fought for in religious contexts in Nigeria (Okoye et al., 2022; VoSS et al., 2024). Environmental stewardship (SDG 13) scored moderate agreement with a 64.7% score only (M = 3.56, SD = 0.94), which shows the environmental qualities of the religious teachings are not completely tied in the consciousness of the community yet (Dwivedi et al., 2022).

Chi-Square Test of Associations

To determine whether statistically significant associations existed between religious variables and SDG-related outcomes, chi-square tests of independence were conducted at the 0.05 significance level. The results are summarized in Table 3.

Table 3: Chi-Square Test Results for Religion-SDG Associations

Variable Pair	Chi-Square (x^2)	df	p-value	Decision
Religious affiliation & poverty alleviation engagement (SDG 1)	18.43	4	0.001	Significant
Religious participation & educational support (SDG 4)	21.67	4	0.000	Significant
Religious teachings & gender equality perception (SDG 5)	9.82	4	0.044	Significant
Religious institution involvement & health outcomes (SDG 3)	16.75	4	0.002	Significant
Religious values & environmental action (SDG 13)	7.34	4	0.119	Not Significant
Religious leadership & peace/conflict resolution (SDG 16)	14.21	4	0.007	Significant

*Source: Field Survey, 2026. *p < .05, **p < .01*

Chi-square analysis indicated statistically significant associations exist between religious participation and a number of SDG-related outcomes. The best link was between religious participation and education support (SDG 4) ($x^2 = 21.67$, df = 4, p = 0.000); this was followed by poverty alleviation (SDG 1) ($x^2 = 18.43$, df = 4, p = 0.001). Religious institution involvement was found to be significantly associated with health outcomes (SDG 3) ($x^2 = 16.75$, df = 4, p = 0.002), and religious leadership was found to be significantly associated with peace and resolution of conflict (SDG 16) ($x^2 = 14.21$, df = 4, p = 0.007). A significant but moderate correlation between religious teachings and perceptions of gender equality (SDG 5) was also arrived at ($x^2 = 9.82$, df = 4, p = 0.044).

On the other hand, the relation between religious values and environmental action (SDG 13) was not statistically significant ($x^2 = 7.34$, df = 4, p = 0.119). This implies that, whilst responses to the role of religion in environmental stewardship appeared moderate in their affirmative nature in the descriptive responses, there was no statistically significant structural relationship between religious variables and actionable environmental behaviours identified at a community level.

Correlation Analysis

Pearson correlation analysis was carried out to investigate the strength and direction of relationships between key religious indicators and outcomes related to SDGs. The result obtained is shown in Table 4, which shows the correlation coefficient of the religious engagement index, trust in religious leaders, faith-based organisation (FBO) community participation, and interfaith dialogue engagement against selected SDGs.

Table 4: Correlation Matrix — Religious Variables and SDG Outcomes

Variables	SDG 1	SDG 3	SDG 4	SDG 5	SDG 13
Religious Engagement Index	0.61**	0.57**	0.66**	0.34**	0.29*
Trust in Religious Leaders	0.58**	0.52**	0.59**	0.28*	0.23*
FBO Community Participation	0.54**	0.49**	0.63**	0.31*	0.27*
Interfaith Dialogue Engagement	0.47**	0.44**	0.50**	0.38**	0.33**

*Source: Field Survey, 2026. *p < .05, **p < .01*

The Religious Engagement Index had the highest positive correlation with SDG 4 ($r = 0.66$, $p < 0.01$), which is consistent with the chi-square results. Moderate to strong significant associations were lead with SDG 1 (correlation of 0.61), SDG 3 (correlation of 0.57) and SDG 16 (not reported but presumed from qualitative answers). The smallest but not negligible correlations have been registered with SDG 5 ($r = 0.34$) and SDG 13 ($r = 0.29$). This was also true for trust among religious leaders, which were correlated most with SDG 4 ($r = 0.59$) and least correlated with SDG 13 ($r = 0.23$). These patterns collectively highlight the multidimensional yet differentiated nature of the influence of religion throughout the SDGs.

Discussion of Findings

Religion as a Catalyst for Poverty Alleviation and Education (SDGs 1 and 4)

The results show that the most affirmed roles of religion by respondents are in poverty alleviation (SDG 1), education (SDG 4) with descriptive means and statistically significant values of chi-square and correlation. These findings are consistent with Cooper and Marshall (2024), who postulated that faith communities represent an important non-state force in development service provision, through charity, schools and skills training, for example. In the Nigerian context, education has always been within the domain of both the Islamic and Christian institutions that have been historically involved in providing education facilities and welfare programmes to complement the government provision (Falola et al., 2024). The level of public trust in religious institutions, as documented by Iloabachie et al (2025) and Bazie and Diallo (2025) further adds to the effective reach of poverty interventions based on faith as beneficiaries are more likely to engage with organisations that they perceive as legitimate and morally credible.

These findings are also congruent with the framework of the Value-Belief-Norm (VBN) theory adopted in this study (Simuni et al 2024), whereby altruistic religious values activate moral obligations toward addressing poverty and supporting education. Where the teachings of religions focus on communal responsibility and stewardship, there is scope for it to be converted into tangible pro-SDGs behaviours and institutional investment. This is in line with Voß et al. (2024) that found these positive relationships between religious engagement and health and well-being outcomes, and Sango et al., (2024) document the rising involvement of FBOs in official development assistance frameworks with the SDGs.

The contested nature of Gender equality in religious frame (SDG 5)

The most controversial finding relates to gender equality (SDG 5), which drew the lowest mean score ($M = 3.14$) and the most polarised responses, with almost half of the surveyed (46.7%) disagreeing that religious teachings are conducive to gender equality. This finding echoes a tension which has been documented widely in the literature between values grounded in religious faith and secular notions on gender equality. Okoye et al (2022) noted that religious and cultural practices in Nigerian society generate ethical tensions surrounding marriage and gender relations which often lead to a parenthesising of patriarchal norms while depriving it of transformation. Similarly, the study conducted by Voss et al. (2024) concludes that religious dominance was also linked to gender equality outcomes in a negative relationship in their cross-national analysis.

The moderate but significant chi-square association ($x^2 = 9.82$, $p = 0.044$) and correlation ($r = 0.34$) nonetheless indicate that the degree to which religion is restrictive on gender equality is not homogeneous among religions, but rather depends on the denomination, interpretation, and degree of reform orientation. This corresponds with the multidimensional analytical framework of Koeglsperger, et al. (2023, as cited in related literature) which differentiates between religion as teachings, spirituality, institutions, and worldview, all of which may have different outcomes on gender equity. Progressive religious actors and feminist theological movements both within Islam

and Christianity in Nigeria have been questioning patriarchal conceptions, adding to processes that lead to more equitable social norms (Puen et al 2024; Stiles-Ocran and Leis-Peters 2025) The implication here is that gender equality outcomes from religion is not predetermined but dependent on internal reform and interfaith collaboration.

Contribution of Faith-Based to Health and Well-being (SDG 3)

The significant relationship between the involvement of religious institutions and health outcomes (SDG 3) ($x2 = 16.75$, $p = 0.002$) and the corresponding correlation ($r = 0.57$) suggests that religion is a meaningful health promotion resource and community well-being in Oyo town. This is in line with the empirical literature. Voess et al. (2024) found health and well-being to be among the most positively affected SDG domains by religious engagement and Puen et al (2024) described specifically the work of FBO advocacy of reproductive health and family stability in Nigerian communities. Given the documented challenges of health infrastructural deficit in Nigeria, where religious organizations usually activities in the area of health via hospitals, clinics and community health programmes thereby the findings has direct policy relevance for government and non-governmental partnership frameworks (Cooper and Marshall 2024; Gulak et al. 2023).

Religion, Peace and Institutional Justice (SDG 16)

The significant chi-square association between religious leadership and peace and conflict resolution (SDG 16) ($x2 = 14.21$, $p = 0.007$), reflecting the opportunities as well as inherent paradoxes of the role of religion in peacebuilding. As documented by John et al. (2023), the challenges of insurgency and armed banditry facing Nigeria, especially the Northern states states, are undermining the social stability and trust in institutions, and is a direct threat to SDG 16. However, religious leaders, because of their moral authority and their embeddedness in communities, are often placed in the role of mediators in community disputes and as advocates for peace. Abbas et al (2025) noted that immense trust in religious leaderships opens up room for crisis management and social reform which bypasses the faulty state institutions.

The findings therefore strengthen the argument for a dual interpretation of religion, which can be a source of conflict if used for sectarian ends and contribute to positive conflict resolution by building peace if employed in association with interfaith dialogue and institutional justice (Voß et al., 2024; Sango et al., 2024). In Oyo town, a historically Yoruba Muslim and Christian space, it is taken for granted that the relative interreligious tolerance seen in the town is in line with the study by Pappalardo (2024) who observed the importance of local socio-cultural norms in moderating religious conflict. This reinforces the argument by Sachs et al., (2022) that SDG implementation calls for contextual adaptation.

Environmental Stewardship and the Emerging Ecological Consciousness SDG 13

The non-significant result obtained for chi-square with religion and environmental action ($p = 0.119$), together with the weakest correlation values ($r=0.29$ for the Religious Engagement Index), suggests that although the respondents moderately recognized religious responsibility towards the environment, such responsibility has not yet been converted into a statistically consistent pattern of religiously motivated environmental behaviour. This finding is partly congruent with the findings of Zuhdi et al. (2024) which identified suboptimal integration of eco-Islamic teachings in educational contexts as well as Bergmann et al. (2022) which indicated the overemphasis on the Western eco-theological traditions with limited traction in non-OECD contexts.

Dwivedi et al. (2022) proposed that religious and spiritual values be added to the existing pillars of sustainable development, as a fourth pillar to complement and balance the other three pillars of economic, social and environmental development. The current data presented indicate that this

aspiration, although theoretically sound, has great problems in its implementation at the grassroots level in Nigeria. The cultural tension in the mismatch between normative ecological teachings and levels of behavioural environmental engagement suggest that there is a critical need for faith-based environmental literacy programs that can translate abstract theological teachings about creation stewardship into concrete, SDG-aligned community actions.

Conclusion

This work focused on the contribution of religion as achieved in the Sustainable Development Goals (SDGs) in Nigeria with focus on the Oyo town, Oyo State. Drawing on data obtained from 150 religiously active participants using a descriptive qualitative design, aided with quantitative statistical analysis, the research has produced empirical evidence of the multidimensional and context-dependent nature of the influence of religion on the outcomes of sustainable development. The results confirm that religion has an important enabling role to play in promoting a number of SDGs in Nigeria, especially education (SDG4), poverty reduction (SDG1), health and well-being (SDG3), and peace and institutional justice (SDG16). Religious institutions in Oyo town are seen by the vast majority of the people in the study as active contributors to the development results, which aligns with the widely agreed-upon academic consensus that states that faith-based organizations and religious leaders are credible community-embedded development actors in societies with a overriding low level of institutional trust (Cooper and Marshall 2024; Iloabachie et al 2025; Sango et al., 2024). The high level of trust in religious leaders, reported in this and previous studies, makes faith-based development initiatives potentially very widely reaching and effective.

There are, however, critical tensions and limitations in religion's developmental role, the study also points out. The contesting and ambivalent dynamic between religious teachings and gender equality (SDG 5) is the evidence of the long-standing patriarchal structures in both Christian and Islamic traditions in Nigeria, which can be inimical to achieving the goals of inclusive and equitable development results (Voß et al., 2024; Okoye et al. 2022). Similarly, it was observed that the non-significant relationship of religious values and environmental action (SDG 13) indicates that ecological responsibility has not yet been fully internalised within the practical religiosity of the communities studied, and includes a significant gap that limits the contribution of religion in climate-related SDGs (Dwivedi et al. 2022; Bergmann et al. 2022).

Theoretically, the study supports the use of the Value-Belief-Norm theory in the analysis of faith-based pro-SDG behaviours. The abbreviated causal chain from altruistic religious values, all the way to belief activation, ascription of responsibility and pro-sustainable action are empirically supported for SDGs 1, 3 and 4 while the same for SDGs 5 and 13 to a lesser extent that the theory's explanatory power is conditioned by cultural, denominational and institutional factors particular to Nigerian society. This finding adds to the growing literature of arguing for context-sensitive uses of development theories in sub-Saharan Africa (Oyedun et al. 2025; Butu et al. 2023).

Overall, this study concludes that religion is neither an absolute product-enabler nor a homogenous product-obstacle to SD in Nigeria. Its role is a dynamic, stratified, deeply-embedded one in local socio-political and cultural configurations. Maximizing positive contributions while Strain Mitigating Strain effects of climate change calls for intentional and evidence based engagement strategies which cooperate with religious establishment as co-architects of sustainable development and not peripheral as end users. The aspirations of no one left behind contained in the SDGs will be best served by Physics of Prosperity the ability of religious helicopters systematic integration of community to national and subnational levels of development planning; institutional capacity of ANMs charged collectively with the assignment of the national and

subnational efforts with responsibility to ensure that achievement of the SDPs on or by 2030 is a matter of moral authority, village, district, state, and country level capacity as well as of those responsible for the global understanding of the Sustainable Development Goals. The aspirations of no one left behind contained in the SDGs will be best served by Physics.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are advanced for policy makers, religious leaders, development practitioners and researchers:

Strengthening Faith-Based Development Partnerships

The Nigerian government with the support of international development organizations should formalize and scale up partnership frameworks with faith-based organizations for the provision of SDG related services, especially in the areas of education (SDG 4), health (SDG 3) and poverty alleviation (SDG 1). Given the documented trust deficit in public institutions (Bazie and Diallo 2025), both the channelling of development resources through credible religious organizations to promote the project and increased community uptake are potential ways to mitigate the leakage as well as promote greater accountability. State governments in Oyo as well as other mostly religious states should create Faith and Development Desks in their States SDG coordination offices to help them engage and work structuredly with registered FBOs.

Mainstreaming the Goal of Gender Equality in Religious Discourse

Religious leaders and denominational bodies need to be actively involved in gender transformative dialogues that confront the patriarchal interpretation of the scripture and tradition. In the light of the empirically documented resistance to gender equality norms within religious communities (SDG 5), targeted capacity-building programmes ought to be developed to empower progressive religious actors within both Islam and Christianity to call for women's rights, girls' education and economic empowerment from within explicit religious context frameworks (Puen et al., 2024; Stiles-Ocran and Leis-Peters, 2025). National bodies like Christian Association of Nigeria (CAN) and Supreme Council for Islamic Affairs (NSCIA) should provide official guidelines on gender equity aligned to the focus on SDG5 targets.

Promoting Eco-theology and Religious Environmental Literacy

Given the low and insignificant links between religious engagement and environmental action (SDG 13), more urgent focus should be given to t mainstreaming ecological stewardship into religious education curriculum, sermons and community programmes. Religious Seminaries, theological colleges and Islamic institutes across Nigeria should include as part of their training programmes courses on eco-theology, creation care, and climate justice. This recommendation is in line with the call of Dwivedi et al. (2022) for religion as a fourth pillar of sustainable development and Zuhdi et al. (2024) on the suboptimal integration of eco-religious teachings in educational institutions. Community-based efforts in environmental stewardship campaigns by trusted religious figures can also lead towards grassroots action on SDG 13.

Taking Advantage of Interreligious Dialogue to Promote Peace and Security

In recognition of the major link between religious leadership and the outcome of peace (SDG 16), the role of interfaith platforms such as the Interfaith Mediation Centre and the Nigeria Inter-Religious Council (NIREC) should be enhanced and supported with sufficient funding, legal support and operational support. Religious leaders to be engaged as formal stakeholders in national and subnational security councils, especially in conflict affected areas in northern Nigeria. Training programmes on non-violent communication, trauma-informed peacebuilding and

mediation should be provided to religious leaders to give them practical skills for de-escalating communal and sectarian tensions (John et al., 2023; Abbas et al 2025).

Investment in Research and Longitudinal Data

The methodological limitations of the present study as well as the localized nature of the same, reveals the necessity for stronger empirical research on religion and development in Nigeria. In future research it is desirable that longitudinal studies be conducted with mixed-methodology to measure the extent of changes in religious engagement and SDGs outcomes from time to time. Multi-site studies with diverse geo-political zones of Nigeria would promote the generalisability of findings. Particular attention should be given to causal mechanisms that relate specific religious practices, denominational differences, and SDG outcomes in solving the endogeneity and selection bias problems identified in previous literature (Voß et al., 2024). The National Bureau of Statistics and research institutions are to include religion - SDG indicators in the national surveys and framework of development monitoring.

Policy Integration with Religion in Nigeria's SDG Voluntary National Review

Nigeria's Voluntary National Review (VNR) to be submitted to the United Nations High-Level Political Forum on Sustainable Development should expressly include an assessment of the contributions and constraints of religious actors to SDG implementation. This would signify that religion has been acknowledged as a legitimate development actor in Nigeria and could attract more international support to faith-sensitive development programming (Sango et al., 2024; Sachs et al., 2022). A national mapping of faith-based organisations that get involved in SDG-related activities will open the data infrastructure to evidence-based policy integration.

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PREDICTIVE INFLUENCE ETHNOMATHEMATICAL AND CONTEXTUALIZED PEDAGOGIES ON STUDENTS' ENGAGEMENT IN MATHEMATICS AND SCIENCE LEARNING FOR SUSTAINABLE DEVELOPMENT

[1]Sunmola Kadiri Adegoke (PhD),
adegokekadiri@gmail.com;

[2]Yemisi Adeola Ayoola (PhD),
ayoolayemisiadeola3@gmail.com;

[3]Adekemi Olufunke Akanbi,
akanbi.adekemi@gmail.com;

[4]Taye Mufutaudeen,
mufutaudeen_taye@unilesa.edu.ng

[5]Samuel Olusola Esho,
olusola_esho@unilesa.edu.ng

[6]Timothy Oyebode Oyedokun,
oyebode_oyedokun@unilesa.edu.ng

[1,2,3,4,5,6]Department of Science, Technology and Mathematics Education, Faculty of Education, University of Ilesa, Ilesa, Osun State

Abstract
The study examines the predictive influence ethnomathematical and contextualized pedagogies on students' engagement in Mathematics and Science Learning for Sustainable Development**.** This study adopted a quantitative, correlational research design. The population of the study comprises all science students enrolled in public secondary schools across Osun State, Nigeria with a total of 12,681 students. The sample for the study consisted of 2,160 students, representing approximately 17% of the population. The sample was selected using multistage sampling technique. Data were gathered using a validated and reliable structured questionnaire based on a four-point Likert scale, with a reliability coefficient of 0.78 confirmed through Cronbach's alpha. Analysis was conducted using frequency counts, percentages, means, standard deviations and Pearson Product Moment Correlation (PPMC). The findings revealed that ethnomathematical pedagogy and contextualized pedagogy positively influence students' engagement in mathematics, biology, and science learning. Respondents unanimously agreed that integrating cultural knowledge, local experiences, and real-life situations into teaching enhances students' interest, participation, and understanding of concepts. The study also revealed a significant relationship between ethnomathematical and contextualized pedagogies, indicating that both approaches work together to promote meaningful and engaging learning experiences for Sustainable Development. Therefore, based on these results, the study recommended, among others that School should integrate ethnomathematical concepts into mathematics and science lessons to connect academic content with students' cultural backgrounds and experiences.

Keywords: Ethnomathematics pedagogy, Contextualized pedagogy, Engagement, Mathematics and Science learning, Sustainable development

Introduction

Mathematics and science are not merely abstract or classroom-based disciplines; rather, they function as living practices embedded in everyday life. A growing body of mathematics education literature conceptualizes mathematics as a human activity concerned with patterns, structures, relationships, space, and change, developed to interpret and respond to real-world situations (Bishop, 2020; Niss & Højgaard, 2019). Contemporary theorists further describe mathematics as a pattern-oriented and meaning-making enterprise that emerges from practical human engagements such as counting, measuring, comparing, and organizing experiences (Radford, 2021). In addition, current sociocultural perspectives emphasize that mathematics is a socially constructed body of knowledge shaped by cultural practices, values, and human purposes (Bishop, 2020; Ernest, 2023). This understanding strongly aligns with African contexts, where mathematical ideas are manifested in land measurement, architectural design, trade systems, textile patterns, and artisanal craftsmanship.

From a Nigerian perspective, contemporary scholars increasingly argue that mathematics is deeply embedded in indigenous knowledge systems and everyday problem-solving practices. Empirical studies on mathematics education highlight that traditional African societies routinely apply mathematical reasoning in farming systems, market transactions, construction, measurement, and time reckoning, even though these practices are often marginalized within formal school curricula (Abah, 2021; Ezeife & Bishop, 2022). Moreover, current research in culturally responsive mathematics education emphasizes that mathematics learning becomes more meaningful and engaging when instruction explicitly connects with learners' cultural environments, community practices, and lived experiences (Ogunleye & Awofala, 2022; Umoren, 2023).

Science, on the other hand, is increasingly conceptualized as a systematic, evidence-based process of inquiry through which knowledge about natural and social phenomena is generated and refined. Recent science education scholarship emphasizes that science involves practices such as observation, experimentation, data analysis, modelling, argumentation, and the development and testing of explanations grounded in empirical evidence (Osborne, 2020; Erduran & Dagher, 2021). This contemporary view extends science beyond formal laboratory settings to include knowledge constructed through sustained and purposeful interaction with the environment. Within this framework, indigenous African practices related to agriculture, weather prediction, animal husbandry, herbal medicine, and environmental management exemplify scientific reasoning rooted in careful observation, pattern recognition, experimentation, and experiential learning accumulated over generations.

Nigerian and African scholars similarly contend that science is deeply embedded in community practices and indigenous knowledge systems. Recent studies emphasize that African Indigenous Knowledge Systems (AIKS) constitute systematic, empirical, and context-sensitive ways of knowing, developed through generations of observation, trial, and adaptation to local environments. For example, Blackie (2024) argues that indigenous science represents valid epistemological systems grounded in sustained environmental interaction, experiential learning, and practical problem-solving, and that such knowledge systems are essential for culturally relevant and inclusive science education. Within the Nigerian context, Ogunniyi (2020) maintains that indigenous scientific knowledge should be recognized as complementary to Western science in formal education, as its exclusion often leads to learner alienation and reduced relevance of school science.

In everyday activities such as farming, building, trading, craftsmanship, navigation, and environmental management, African communities engage simultaneously in mathematical and scientific reasoning. Farmers estimate quantities, predict seasonal cycles, and optimize resource use, while artisans apply geometric reasoning and material properties in construction and tool-making. These forms of indigenous knowledge have enabled communities to thrive for generations. However, despite their relevance and sophistication, such locally grounded mathematical and scientific practices remain largely absent from formal school mathematics and science instruction, resulting in a disconnect between learners' lived experiences and classroom learning.

As African nations advance toward the Sustainable Development Goals, the quality and relevance of mathematics and science education have therefore emerged as critical imperatives. However, instructional practices that marginalize learners' cultural and lived experiences risk producing knowledge without relevance and skills that fail to translate into real-world impact. This disconnect has continued to limit students' meaningful engagement in disciplines that are critical to Africa's sustainable future.

In response, this study investigates how ethnomathematical and contextualized pedagogical approaches, rooted in African cultural realities, can predict and enhance students' engagement in mathematics and science learning. Ethnomathematical pedagogy refers to instructional strategies that integrate learners' cultural practices, local knowledge systems, and community experiences into mathematics and science teaching, enabling students to connect abstract concepts with familiar, culturally grounded contexts and everyday activities. Evidence from ethnomathematics research indicates that when instruction draws on learners' cultural ways of knowing and doing mathematics, students perceive the content as more meaningful and engaging and are better able to relate school mathematics to their lived experiences (Sari, Nugroho, & Pratiwi, 2024; Jacob & Dike, 2023). Ethnomathematical pedagogy - which embeds local cultural practices and community problem-solving into mathematics and science instruction - has been shown to make abstract concepts more meaningful and relevant to learners' lives. A recent meta-analysis of ethnomathematics-based learning found that integrating students' cultural contexts into mathematics instruction contributes to improved learning outcomes and increased engagement, as learners are better able to relate academic content to familiar cultural practices and local knowledge (Sari, Nugroho, & Pratiwi, 2024). Similarly, contextualized pedagogy refers to instructional approaches that situate learning tasks within meaningful, real-world contexts reflecting students' everyday experiences, environments, and challenges, enabling learners to perceive the relevance of academic content to their lives and communities. Recent empirical research highlights that when academic content -particularly in mathematics and science - is framed within authentic contexts, students demonstrate greater interest, active participation, and engagement, because they can directly connect what they are learning to practical problems and familiar situations (Ramaila, 2025). Research conducted in secondary mathematics classrooms in Zambia shows that integrating indigenous pedagogies and culturally relevant examples into geometry instruction significantly enhanced students' engagement, enthusiasm, and conceptual understanding, highlighting the importance of linking classroom tasks to students' lived cultural realities (Mulenga, Folokwe & Spangenberg, 2025).

Research from Nigeria demonstrates that when mathematics instruction incorporates local cultural concepts and practices, students exhibit greater engagement, more positive attitudes toward mathematics, and richer classroom interaction, underscoring the importance of linking learning to students' lived social and cultural realities (Enun & Iyaji, 2025). Similarly, Jacob and Dike (2023) examined ethnomathematics and culturally responsive pedagogy in mathematics learning. Their

study established that ethnomathematics is more effective when integrated with culturally responsive teaching practices that connect classroom concepts to students' cultural realities. The authors further reported that this integration enhances learners' conceptual understanding, creativity, and active classroom participation, thereby making mathematics learning more meaningful and relevant

By aligning instruction with learners' cultural experiences and daily realities, such ethnomathematical and contextualized pedagogies have the potential to strengthen education as a catalyst for sustainable development across the continent.

Research Objectives

The study seeks to investigate the influence of ethnomathematical and contextualized pedagogical approaches on students' engagement in mathematics and science learning. Specifically, the study seeks to:

1. examine the extent to which ethnomathematical pedagogy predicts students' engagement in mathematics and science learning.
2. determine the extent to which contextualized pedagogy predicts students' engagement in mathematics and science learning.
3. compare the relative contributions of ethnomathematical and contextualized pedagogies in enhancing students' engagement in mathematics and science learning.
4. assess the combined effect of ethnomathematical and contextualized pedagogical approaches on students' engagement in mathematics and science learning.

Research Questions

Based on the objectives, the study seeks to answer the following questions:

1. What is the extent of ethnomathematical pedagogy on students' engagement in mathematics and science learning?
2. What is the extent of contextualized pedagogy on students' engagement in mathematics and science learning?

Research Hypotheses

1. There is no significant relationship between ethnomathematical and contextualized pedagogy on students' engagement in mathematics and science learning

Methodology

Research design

This study adopted a quantitative, correlational research design to investigate the predictive influence of ethnomathematical and contextualized pedagogical approaches on students' engagement in mathematics and science learning. The design is appropriate because it allows for the examination of the relationships and predictive effects between independent variables (ethnomathematical pedagogy and contextualized pedagogy) and the dependent variable (students' engagement) without manipulating the study environment.

Population of the study

The population for this study consisted of all science students enrolled in public secondary schools across Osun State, Nigeria with a total of 12,681 students. These students represent a diverse demographic, providing a rich context to examine how culturally and contextually responsive pedagogies influence engagement in mathematics and science learning.

Sampling procedure and sample size

A multistage sampling technique was employed to select a representative sample. In the first stage, Osun State was stratified into its three senatorial districts (Osun East, Osun Central, and Osun West) to ensure geographical representation. In the second stage, secondary schools offering science subjects were randomly selected from each district. In the third stage, intact science classes were randomly selected from the sampled schools to maintain the natural classroom environment. Finally, a simple random sampling technique was used to select individual students from these classes, resulting in a total sample of 2,160 students, representing approximately 17% of the population. The selected sample size was considered adequate for the intended predictive analyses, including multiple regression, ensuring statistical power and representativeness.

Instrumentation

Data were collected using structured questionnaires designed to measure students' engagement in mathematics and science as well as the extent to which ethnomathematical and contextualized pedagogical practices are implemented. The instruments were validated through expert review and a pilot study to ensure clarity, reliability, and relevance to the study objectives. Reliability coefficients (Cronbach's alpha) for all scales exceeded the recommended threshold of 0.70, indicating acceptable internal consistency.

Data Collection Procedure

Permission was obtained from relevant educational authorities and school administrators before data collection. Questionnaires were administered in classrooms under the supervision of the researchers and trained research assistants. Students were briefed on the purpose of the study and assured of the confidentiality of their responses.

Data Analysis

Data were analyzed using descriptive statistics to summarize respondents' demographic characteristics and key study variables. Frequency count, percentage, mean and standard deviation were used to answer the research questions raised. Inferential statistics, specifically Pearson Product Moment Correlation (PPMC). analysis, was employed to examine the predictive influence of ethnomathematical and contextualized pedagogical approaches on students' engagement in mathematics and science learning. Statistical significance was evaluated at the 0.05 level.

Results

Research Question 1: What is the extent of ethnomathematical pedagogy on students' engagement in mathematics and science learning?

Table 1: Descriptive Analysis of the extent of ethnomathematical pedagogy on students' engagement in mathematics and science learning?

S/n	the extent of ethnomathematical pedagogy on students' engagement in mathematics and science learning	SA (%)	A (%)	D (%)	SD (%)	Mean	Standard Deviation	Remark
1	My Mathematics and Science teachers use examples from my everyday life and community to explain lessons.	707 (32.7)	1271 (58.8)	168 (7.8)	14 (0.6)	3.24	0.61	Agree
2	Learning Mathematics and Science through local activities (such as farming, trading, building, or crafts) makes the subjects easier to understand.	1121 (51.9)	1026 (47.5)	6 (0.3)	7 (0.3)	3.51	0.52	Agree
3	I feel more interested in Mathematics and Science when lessons include cultural practices or real-life experiences familiar to me.	559 (25.9)	1279 (59.2)	315 (14.6)	7 (0.3)	3.11	0.64	Agree
4	Using local methods and materials in teaching helps me remember what I learn in Mathematics and Science.	1129 (52.3)	878 (40.6)	0.00	153 (7.1)	3.38	0.81	Agree
5	Ethnomathematical teaching helps me see how Mathematics and Science are useful in solving real-life problems.	716 (33.1)	1123 (52.0)	314 (14.5)	7 (0.3)	3.18	0.68	Agree
6	I understand Mathematics and Science concepts better when teachers relate them to my culture and environment.	1129 (52.3)	873 (40.4)	0.00	158 (7.3)	3.38	0.82	Agree
7	I prefer Mathematics and Science lessons that connect classroom topics with indigenous or traditional knowledge	867 (40.1)	1123 (52.0)	163 (7.5)	7 (0.3)	3.32	0.62	Agree
8	When Mathematics and Science lessons include local or cultural examples, I participate more actively in class.	716 (33.1)	1286 (59.5)	0.00	158 (7.3)	3.19	0.77	Agree
9	Using familiar community activities in teaching makes me more interested in Mathematics and Science lessons.	1122 (51.9)	560 (25.9)	471 (21.8)	7 (0.3)	3.29	0.81	Agree
10	I pay more attention in Mathematics and Science classes when teachers relate topics to indigenous practices or everyday life.	1118 (51.8)	873 (40.4)	6 (0.3)	163 (7.5)	3.36	0.83	Agree
11	Ethnomathematical teaching encourages me to ask questions and share my ideas during lessons.	1799 (83.3)	155 (7.2)	178 (8.2)	28 (1.3)	3.72	0.67	Agree
12	I feel motivated to learn Mathematics and Science when lessons are connected to my culture and environment.	12 (0.6)	2032 (94.1)	60 (2.8)	56 (2.6)	2.93	0.36	Agree
13	Lessons that include ethnomathematical examples make me want to study Mathematics and Science more seriously.	1270 (58.8)	713 (33.0)	163 (7.5)	14 (0.6)	3.49	0.66	Agree

Cut -Off Mean; 2.50

Table 1 identified the extent of ethnomathematical pedagogy on students' engagement in mathematics and science learning. Using a cut-off mean of 2.50 for the rating scale. All the respondents unanimously agreed on the positive influence of ethnomathematical pedagogy on students' engagement in mathematics and science learning It indicates that integrating indigenous knowledge, cultural practices, and local experiences into instruction enhances students' interest, participation, and understanding of mathematical and scientific concepts.

Research Question 2: What is the extent of contextualized pedagogy on students' engagement in mathematics and science learning?

Table 2: Descriptive Analysis of extent of contextualized pedagogy on students' engagement in mathematics and science learning

S/n	the extent of contextualized pedagogy on students' engagement in mathematics and science learning	SA (%)	A (%)	D (%)	SD (%)	Mean	Standard Deviation	Remark
14	My Mathematics and Science teachers explain lessons using examples from my daily life and surroundings.	1123 (52.0)	716 (33.1)	162 (7.5)	159 (7.4)	3.29	0.89	Agree
15	I understand Mathematics and Science better when teachers relate topics to real-life situations	721 (33.4)	1286 (59.5)	153 (7.1)	0.00	3.26	0.58	Agree
16	Classroom activities in Mathematics and Science reflect problems I see at home, in school, or in my community.	718 (33.2)	1429 (66.2)	6 (0.3)	7 (0.3)	3.32	0.49	Agree
17	Learning Mathematics and Science becomes more meaningful when lessons are connected to real-world experiences	310 (14.4)	1681 (77.8)	6 (0.3)	163 (7.5)	2.99	0.67	Agree
18	Context-based teaching helps me apply what I learn in Mathematics and Science outside the classroom.	566 (26.2)	1437 (66.5)	157 (7.3)	0.00	3.19	0.55	Agree
19	I feel more confident in Mathematics and Science when lessons are taught using familiar situations.	150 (6.9)	1971 (91.3)	18 (0.8)	21 (1.0)	3.04	0.34	Agree
20	Mathematics and Science lessons are more interesting when teachers use practical and real-life examples.	723 (33.5)	1279 (59.2)	158 (7.3)	0.00	3.26	0.58	Agree
21	When Mathematics and Science lessons are taught using real-life examples, I am more actively involved in class.	0.00	1991 (92.2)	162 (7.5)	7 (0.3)	2.92	0.29	Agree
22	Relating Mathematics and Science topics to everyday situations makes me more interested in learning.	719 (33.3)	1283 (59.4)	158 (7.3)	0.00	3.26	0.58	Agree
23	I pay better attention in Mathematics and Science classes when lessons are connected to my environment.	720 (33.3)	1282 (59.4)	0.00	158 (7.3)	3.19	0.77	Agree

24	Context-based teaching encourages me to participate in discussions and class activities.	1122 (51.9)	560 (25.9)	471 (21.8)	7 (0.3)	3.29	0.81	Agree
25	I feel more motivated to learn Mathematics and Science when teachers use familiar and practical situations.	563 (26.1)	1439 (66.6)	158 (7.3)	0.00	3.19	0.55	Agree
26	Mathematics and Science lessons that reflect real-world experiences make me want to engage more in learning activities.	1286 (59.5)	721 (33.4)	153 (7.1)	0.00	3.52	0.63	Agree

Cut -Off Mean; 2.50

Table 2 identified the extent of contextualized pedagogy on students' engagement in mathematics and science learning. Using a cut-off mean of 2.50 for the rating scale. All of the respondent agreed on the contextualized pedagogy positively influences students' engagement in mathematics and science learning. The respondents affirmed that relating classroom instruction to real-life situations and learners' immediate environment increases students' interest, active participation, and understanding of concepts.

Testing of Hypotheses

Hypothesis 1: There is no significant relationship between Ethnomathematical and Contextualized pedagogy on students' engagement in mathematics and science learning.

The Ethnomathematical and Contextualized pedagogy on students' engagement in mathematics and science learning data were gathered from the answers provided by respondents to items 1–26 in Section B, and C of the Ethnomathematical and Contextualized Pedagogies on Student' Engagement Questionnaire (ECPASEQ) to evaluate this hypothesis. Responses to questions in Section D and E of the of the Ethnomathematical and Contextualized Pedagogies on Student' Engagement Questionnaire (ECPASEQ) were used to compile this data. Pearson's product-moment correlation tests were performed at the 0.05 level to determine statistical significance. Table 3 displays the final result.

Table 3: Relationship between Ethnomathematical and Contextualized pedagogy on students' engagement in mathematics and science learning.

Variables	N	Mean	Stand Dev	r-cal	P-value
Ethnomathematical pedagogy	2160	43.10	5.09	0.841*	0.000
Contextualized pedagogy	2160	41.74	4.03		

*P<0.05

Table 3 showed that the r-cal value of 0.841 was significant at 0.05 level of significance because the P-value (0.000) < 0.05. The null hypothesis is rejected. This implied that there was significant relationship between Ethnomathematical and Contextualized pedagogy on students' engagement in mathematics and science learning.

Discussion of the findings

The findings showed that there was positive influence of ethnomathematical pedagogy on students' engagement in mathematics and science learning This is in agreement with that of Sari, et, al., (2024) who examined Effectiveness of ethnomathematics-based learning on students'

mathematical literacy: A meta-analysis study. The ethnomathematics-based learning found that integrating students' cultural contexts into mathematics instruction contributes to improved learning outcomes and increased engagement, as learners are better able to relate academic content to familiar cultural practices and local knowledge

The findings also showed that the contextualized pedagogy positively influences students' engagement in mathematics and science learning. This is consistent with the submission of Ramaila (2025) who examined Contextualized learning as a theoretical framework. Journal of Teaching and Learning. The findings highlight that when academic content -particularly in mathematics and science - is framed within authentic contexts, students demonstrate greater interest, active participation, and engagement, because they can directly connect what they are learning to practical problems and familiar situations

The findings further showed that there was significant relationship between Ethnomathematical and Contextualized pedagogy on students' engagement in mathematics and science learning. This is corroborating with the submission of Prince Kusi and Bonyah (2025) synthesized evidence on ethnomathematics and culturally responsive pedagogy. The review found consistent evidence that integrating ethnomathematics with contextualized teaching practices leads to improvements in students' engagement, conceptual understanding, and academic performance. The authors concluded that the two pedagogical approaches are complementary and jointly support meaningful mathematics learning.

Conclusion

Based on the findings of this study, it could be concluded that, ethnomathematical pedagogy and contextualized pedagogy positively influence students' engagement in mathematics, biology, and science learning. Respondents unanimously agreed that integrating cultural knowledge, local experiences, and real-life situations into teaching enhances students' interest, participation, and understanding of concepts. The study also revealed a significant relationship between ethnomathematical and contextualized pedagogies, indicating that both approaches work together to promote meaningful and engaging learning experiences for Sustainable Development

Recommendations of the Study

Based on the finding, the following recommendations were made:

1. School should integrate ethnomathematical concepts into mathematics and science lessons to connect academic content with students' cultural backgrounds and experiences.
2. Government should encourage teachers to use contextualized teaching strategies that relate lessons to real-life situations and local community practices.
3. Government should provide professional development programs and training workshops to help educators effectively implement ethnomathematical and contextualized pedagogies.
4. Government should develop instructional materials and learning resources that incorporate indigenous knowledge, cultural practices, and locally relevant examples.
5. Promote collaborative learning activities that allow students to explore and apply mathematical and scientific concepts within meaningful cultural and community contexts.

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GENDER, INCLUSIVE EDUCATION AND SUSTAINABLE DEVELOPMENT OF SUB-SAHARAN AFRICAN COUNTRIES: EMPIRICAL EVIDENCE FROM NIGERIA

SALAKO Gbadebo Ph.D
salakog@eauedoyo.edu.ng/+2348035738686
Department of Economics Education
Faculty of Social Science Education
Emmanuel Alayande University of Education,
P.M.B 1010, Oyo, Oyo State, Nigeria

Folorunso Adekemi AJASA Ph.D
ajasafa@eauedoyo.edu.ng/+2348035803548
Department of Primary and Early Child Education
Emmanuel Alayande University of Education,
P.M.B 1010, Oyo, Oyo State, Nigeria

Abstract
African nations have begun to show proactiveness, resilience, and determination towards mitigating the supremacy of the West in the pursuit of Sustainable Development Goals (SDGs). This study examines the relationship among gender, inclusive education and sustainable development in Nigeria from 2000 to 2024, using secondary time-series data obtained from the National Bureau of Statistics (NBS) and the World Bank. It applies the Autoregressive Distributed Lag (ARDL) Bounds testing method with Granger Causality analysis. The findings indicate a consistent, long-term co-integration relationship among the variables. The long-term coefficients show that a 1% enhancement in gender equality results in a 0.45% rise in sustainable development, as assessed by Real GDP per capita. The Error Correction Model (ECM) also reflects a moderate adjustment speed, with 35.22% of short-term disequilibrium rectified each year. Granger causality tests indicate a two-way connection between inclusive education and economic growth, implying that inclusive systems promote development, which subsequently creates the financial capability for additional investment in education. It also shows that elevated inflation and poverty levels impose considerable adverse effects on developmental results. The research finds that reaching Nigeria's sustainable development targets is closely connected to removing gender and socio-economic obstacles to education. It suggests that increasing public investment in gender equality, enhancing inclusive education systems, and establishing oversight mechanisms, among others, will guarantee fair learning opportunities for all students, especially those with disabilities and from vulnerable backgrounds.

Keywords: Gender Parity, Inclusive Education, Sustainable Development, ARDL, Human Capital

Introduction

In Africa, where rapid population growth, urbanization, and persistent inequalities shape development trajectories, the interplay between gender, inclusive education, and sustainable development is particularly salient. Nigeria, as Africa's most populous country and a key economic powerhouse, offers a compelling case study for these dynamics. With an estimated 18.5

million out-of-school children approximately 60% of whom are girls the country faces one of the world's largest education crises (UNESCO GEM Report Team, 2025; World Bank, 2025).

"Sustainable development refers to development that fulfills current needs without endanger future generations' capacity to satisfy their own needs." It is a convergence of three foundations comprises economic, social, and environmental of life. Certain principles encompass equality, sustainable living, social advancement, and conscientious consumption. In every societal change, education serves as a way to acquire knowledge and skills essential for individuals and the community. Its role is complex; each learner's personality needs to be nurtured, and they should be taught what is important and socially appropriate within their society. The Sustainable Development Goals (SDGs) of the United Nations and the African Union's Agenda 2063 emphasize education as a key facilitator for gender equality and empowerment (UNESCO, 2025; Emeka, 2025).

Inclusive education involves tackling all obstacles and ensuring quality education access to accommodate the varied needs of all students within the same educational setting. This framework goes beyond disability to include gender, socio-economic status, and ethnicity (The National Policy on Inclusive Education, 2023). It plays a crucial role in promoting social unity throughout the African continent. In Nigeria, it is a progress in education that guarantees every student, irrespective of their background, can access quality learning opportunities. This system contrasts sharply with an exclusive system in which children are separated from their disabled peers.

As noted by UNESCO (2005) and Coleman (2013), this system addresses varied needs by enhance

ng participation and minimizing exclusion, guaranteeing every child has an equal entitlement to education that meets personal needs. Akudo and Ezebuiro (2019) suggest that children with special needs, particularly those who are hearing-impaired, should be given the opportunity to experience a regular school environment with the necessary assistance among their classmates. As a result, this system allows all students to attend local schools in age-appropriate, standard classes where they receive support to learn, engage, and take part in all areas of life (Okoro & Obizue, 2016).

Inclusive education is globally acknowledged as a principle for achieving fairness and justice, particularly for individuals marginalized because of disabilities (Dike, 2014). Nigeria's pursuit of sustainable development is closely connected to its capacity to deliver this education to its varied populace. Although advancements have occurred, millions of Nigerians continue to be marginalized because of their location and economic standing. During 2015, world leaders convened in Paris to establish a roadmap for sustainable development by endorsing the 2030 agenda (SDGs) aimed at providing inclusive quality education and lifelong learning for everyone.

A number of challenges impede the success of these policies in Nigeria, such as insufficient teacher training, lack of specialized educational materials, absence of physical infrastructure, security issues, and unequal funding (Oginni, Umar, & Others, 2025). These concerns prompt inquiries on how to attain sustainable development via inclusive education. This study seeks to explore the connection between gender, inclusive education, and sustainable development results in Nigeria, particularly analyzing the moderating effect of inclusive education on the link between gender equality and economic growth. This study is directed by the inquiries below:

1. What is the nature and magnitude of the relationships between gender, inclusive education and sustainable development outcomes in Nigeria?
2. To what extent does inclusive education moderate the relationship between gender parity in education and sustainable development outcomes in Nigeria?

This study contributes to broader African discourses, proposing scalable interventions and a holistic framework aligned with continental and global agenda. The study proceeds with a literature review, followed by methodology, findings, discussion, and policy recommendations.

Literature Review

Conceptual Clarifications

The concept of gender is central to understanding inequalities in education and their effects on sustainable development. In contrast to biological sex, which indicates physiological distinctions, gender is a societal construct influenced by cultural, historical, and social standards. It includes the responsibilities, actions, identities, and power dynamics attributed to people according to perceived masculinity or femininity (Alikor, 2026; Ramanan, 2025; Federal Ministry of Education, 2023). These socially created traits differ between cultures and areas and are constantly recreated via socialization within families, communities, educational institutions, and media.

In African and Nigerian educational discussions, gender is frequently seen through a relational perspective that emphasizes how societal norms sustain disparities. In many areas of Nigeria, especially in the north, conventional norms allocate household responsibilities to girls, while boys are viewed as future providers. These standards appear in behaviours like child marriage, a bias towards educating boys, and increased domestic duties for girls, all of which significantly hinder girls' access to education and their completion rates (Alikor, 2026; Azeez, 2026; Isana et al., 2026). Moreover, gender interacts with additional social categories like disability, poverty, ethnicity, and religion, forming intricate layers of exclusion. Inclusive education has become a revolutionary method for achieving the right to quality education for every student. It signifies a crucial transition from isolated models to a comprehensive philosophy that welcomes diversity and eliminates obstacles to involvement (Federal Ministry of Education [FME], 2023; Manir, 2025). Program operating in realtime, and no channel exists Program operating in realtime, and no channel exists.

This method recognizes and removes physical, attitudinal, curricular, and policy-related obstacles to success. The policy values diversity regarding ability, socio-economic status, and language, specifically incorporating vulnerable groups like girls facing marriage, street children, child laborers, and individuals impacted by conflict (FME, 2023; Manir, 2025). In contrast to integration, which necessitates that learners conform to the current system, inclusion calls for transformative change in the system through curriculum modification, tailored teaching methods, professional development for educators, accessible facilities, and engagement from the community (FME, 2023; Bright-George & Bobmanuel, 2026).

Table 1: Conceptual Categorization of Gender, Inclusive Education, and Sustainable Development

Concept	Definition	Indicators	Challenges	Strategic Goal
Gender	A societal construct influenced by cultural, historical, and social standards (not biological sex).	Responsibilities, power dynamics, identity, and perceived masculinity/femininity.	Traditional norms, child marriage, bias toward male education, and domestic duties.	Achieving a relational perspective that eliminates societal disparities.
Inclusive Education	A comprehensive philosophy that eliminates obstacles to involvement for all students.	Diversity in ability, socio-economic status, and language; rights-based approach.	Physical, attitudinal, curricular, and policy-related obstacles.	Transformation of the system (curriculum, facilities, and teacher development).
Sustainable Development	Meeting current needs without jeopardizing future generations' capacity to meet theirs.	Economic development, social equity, and environmental sustainability.	Intersectional exclusion (disability, poverty, ethnicity, and religion).	Intergenerational fairness and "Leaving No One Behind" (UN SDG 4 & 5).

Source: Salako & Ajasa, (2026)

The concept of sustainable development has become the leading framework for tackling global and continental issues, highlighting the importance of intergenerational fairness, human welfare, and care for the environment. The most commonly accepted definition, stemming from the 1987 Brundtland Report, characterizes it as “development that satisfies current needs without jeopardizing the capacity of future generations to fulfill their own needs.” This model brings together three interconnected components: economic development, social equity, and environmental sustainability (Emeka, 2025; Alikor, 2026).

Currently, sustainable development is framed by the United Nations 2030 Agenda along with its 17 Sustainable Development Goals (SDGs). These objectives highlight that progress should be inclusive, fair, and ensure that "no one is left behind" (United Nations, 2015; The Sustainable Development Goals Report 2025). Notably, SDG 4 (Quality Education) and SDG 5 (Gender Equality) are acknowledged as crucial enablers for the whole agenda. Studies show that ongoing gender-inclusive education greatly improves productive potential and the quality of governance throughout Africa (Emeka, 2025; UNESCO, 2025).

Holistic gender inclusion across education, health, politics, and economic involvement fosters structural change and enhances sustainable development metrics (Emeka et al., 2025; Asongu, 2024). Alikor (2026) defines gender-responsive education as a clear route to development in Nigeria by confronting discriminatory practices, postponing early marriage, and boosting women's participation in the workforce. These elements help disrupt poverty cycles and create resilient communities.

Worldwide, although educational access has enhanced, notable inequalities remain. Women continue to be underrepresented in educational management and policy-making, even though

enrollment rates at lower levels are nearly equal (UNESCO GEM Report Team, 2025). In Sub-Saharan Africa, completion rates are low, with girls being particularly impacted by conflict, child marriage, and poverty. As a result, projects like UNESCO's youth-centric policy evaluations and collaborative stakeholder platforms seek to expedite SDG 4 via data-driven reforms in areas such as West Africa.

In Nigeria, the Updated National Policy on Inclusive Education (2023) takes a rights-based stance, requiring the elimination of obstacles, modifications to the curriculum, and the conversion of special schools into resource centers (Federal Ministry of Education, 2023). Supporting tools consist of the National Policy on Gender in Basic Education and the AGILE project financed by the World Bank, which has enhanced secondary transition for teenage girls via scholarships and life skills training (World Bank, 2025).

Sustainable Development, Inclusive Education, and Gender in Nigeria

In inclusive education, the concept of gender goes beyond equal enrollment to include fair participation, quality educational results, and empowerment. According to Nigeria's 2023 policy, inclusive systems must eliminate all obstacles, including those based on gender norms, to guarantee that diverse learners succeed collectively (Federal Ministry of Education, 2023; Manir, 2025). Emeka (2025) defines lifelong gender-inclusive education as ensuring equality at primary, secondary, and tertiary levels, contending that this comprehensive approach, which focuses on access, decision-making, and leadership, fosters structural change and enhances advancement on various SDGs.

Alikor (2026) suggests that gender education acts as a direct route to sustainable development in Nigeria by removing discrimination and promoting awareness of collective responsibilities. This strategy postpones early marriage, boosts health results, and strengthens women's involvement in politics and the economy. Yet, ongoing challenges persist as schools frequently uphold entrenched gender norms. Curricula and instructional methods can unintentionally reinforce stereotypes, while gender violence and insufficient infrastructure further solidify exclusion (UNGEI, 2025; Isana et al., 2026).

Nigeria's sustainable development objectives are integrated into national strategies that correspond with the SDGs and Agenda 2063. The Updated National Policy on Inclusive Education (2023) clearly connects gender-sensitive education to human capital growth and national advancement (Federal Ministry of Education, 2023). In support of this, Esther et al. (2025) discovered that inclusive STEM education is linked to improved academic achievements and awareness of sustainability, whereas Olugbade (2025) emphasizes that gender-sensitive digital training for educators' aids in bridging digital skill gaps, thus contributing to broader developmental objectives. Nigeria still experiences a significant number of out-of-school children and ongoing disparities, especially in the northern regions (UNESCO GEM Report Team, 2025; World Bank, 2025). Inclusive education that is responsive to gender needs to consider how norms intersect with various vulnerabilities; for instance, girls with disabilities frequently endure compounded exclusion arising from both ableist and patriarchal perspectives (Oginni et al., 2025).

Inclusive education that is responsive to gender needs to consider how norms intersect with various vulnerabilities; for instance, girls with disabilities frequently encounter dual exclusion stemming from both ableist and patriarchal views (Oginni et al., 2025). Although econometric proof indicates that lifelong gender-inclusive education enhances productive capacity, the theoretical understanding has not consistently been applied in practice. Numerous stakeholders continue to equate inclusive education with special education or simple placement without

sufficient support (Manir, 2025; Bright-George & Bobmanuel, 2026). When properly executed with an emphasis on gender intersectionality, inclusive education provides Nigeria a strong route toward fair and robust systems that enable all students to participate in national and continental development.

Theoretical Underpinnings

This research regarding gender, inclusive education, and sustainable development from Nigerian viewpoints is based on Human Capital Theory and Intersectionality Theory. Human Capital Theory asserts that investments in education, skills, and health improve individual productivity, income, and overall impact on economic growth (Becker, 1964), as demonstrated in contemporary African research. Considering gender and inclusive education, the theory highlights the significant benefits of providing gender education. Alikor (2026) claims that education on gender brings significant social and economic benefits, such as better health results, higher participation of women in the workforce, postponed early marriage, and increased national productivity. Evidence is provided by Emeka (2025), who illustrates through econometric analysis that sustained gender-inclusive education, assessed through gender parity at various educational tiers, greatly enhances growth and the quality of governance in African nations, especially in Nigeria. The theory interprets ongoing gender disparities as lost chances for human capital growth. When girls, particularly those with disabilities or from disadvantaged backgrounds, are marginalized due to socio-cultural standards or insufficient inclusive systems, the country loses possible advancements in innovation, economic diversification, and sustainable development (Emeka et al., 2025; Alikor, 2026). The theory therefore offers a robust economic rationale for gender-responsive inclusive education as a valuable investment that aligns with SDG 4 and Agenda 2063.

Intersectionality Theory, developed by Kimberlé Crenshaw (1989), explores how intersecting social identities like gender, disability, class, ethnicity, religion, and location contribute to distinct experiences of privilege or oppression. This framework is especially significant in Nigeria's varied, multi-ethnic, and multi-religious community, where gender inequalities are not consistent but are intensified by additional factors. Intersectionality clarifies the reasons behind the dual exclusion of girls with disabilities in educational systems, particularly in northern Nigerian states, where significant gender disparities arise from the interactions of cultural norms, insecurity, poverty, and religion (Oginni et al., 2025; Umar, 2025; Okonji, 2024). Intersectionality emphasizes not only gender equality or disability inclusion but also supports measures that tackle various, interconnected obstacles at the same time. Intersectionality shows that realizing SDG 5 (gender equality) and SDG 4 (inclusive education) necessitates transformative actions that break down intertwined inequalities. Emeka (2025) and associated studies on extensive gender inclusion subtly rely on this viewpoint by promoting integrated actions covering education, health, politics, and economics (Emeka et al., 2025). Consequently, the three theories enhance human capital, broaden capabilities, and tackle intersectional vulnerabilities, thereby speeding up advancement toward sustainable development results including economic productivity, social equity, effective governance, and environmental stewardship.

Empirical Review

Emeka (2025) examined the impact of lifelong gender-inclusive education on production capabilities and governance standards across 51 African nations from 2005 to 2022. The research created a lifelong gender-inclusive education (LGIE) index via principal component analysis of gender parity ratios at primary, secondary, and tertiary levels, employing pooled OLS, instrumental fixed effects, and dynamic system GMM estimators. Results showed that elevated levels of lifelong gender-inclusive education greatly improve productive capacity and governance quality. Furthermore, LGIE beneficially influences the connection between productive capacity

and governance, suggesting that ongoing investments in gender-responsive education enhance development benefits. Emeka (2025) on extensive gender inclusion further illustrates that gender-inclusive education, coupled with economic and political engagement, propels structural change and sustainable development metrics in Africa. These econometric studies offer continent-wide proof that Nigeria's issues with gender disparities directly hinder overall governance and productivity improvements.

Umar (2025) performed a survey of individuals with disabilities (PWDs) in North Central Nigeria and discovered notable gender differences in educational achievement and skill development. Through chi-square analysis, the research indicated that 54.8% of female respondents with disabilities lacked formal education, in contrast to 35.6% of male respondents ($\chi^2 = 10.846$, $p < 0.05$). Women were largely found in conventional "feminine" professions (such as tailoring and hairdressing), whereas men prevailed in technical areas (like welding and mechanics). Key obstacles recognized were stigma, poverty, unapproachable infrastructure, and absence of gender-sensitive inclusive policies.

Philomina (2025) explored the execution of inclusive education policies aimed at attaining SDG 4 in primary schools within Imo State through a mixed-methods approach. Results showed moderate advancements in policy awareness but poor implementation caused by a lack of funding, inadequate teacher training in gender-responsive and disability-inclusive teaching methods, and inadequate infrastructure adaptations. The research associated these gaps with hindered advancement toward fair quality education. Alumona (2025) examined public primary schools in Kaduna State and highlighted comparable issues: weak enforcement of the Revised National Policy on Inclusive Education (2023), lack of data on disability prevalence, and inadequate gender-sensitive monitoring systems. Qualitative elements indicated that girls with disabilities endure increased exclusion, leading to decreased participation and poorer learning results.

Okobia (2023) explored how inclusive education and gender impact students' attitudes towards learning, revealing that teacher preparedness plays a crucial role in shaping outcomes. In Technical and Vocational Education and Training (TVET), a 2025 study involving 250 female respondents in Lagos utilizing structural equation modeling revealed that self-efficacy and aspects of social justice (distributive and participatory justice) have a positive and significant impact on gender equity and female involvement. Recognition justice, nonetheless, showed no substantial impact, indicating that systemic resource distribution and decision-making are more important than mere symbolic recognition alone (research on enhancing gender equity in TVET, 2025). Research on pre-service teachers (e.g., Adigun, 2021, still relevant in recent analyses) consistently reveals gender disparities in knowledge and attitudes concerning inclusive education, with female educators frequently achieving better knowledge scores; however, cultural and contextual factors influence these outcomes in Nigeria and other African perspectives.

Methodology

Sources of Data

The study utilizes a quantitative approach through econometric modeling to analyse secondary time-series data on the annual bases covering the period from 2000-2024. The data sourced from various statistical government outlets include the National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN) Statistical Bulletin and World Bank (WDI) & UNDP Reports.

Model Specification

The model specification is in line with the theoretical framework of the Endogenous Growth Theory which posits that investment in human capital (education) drives long-term growth of the country. Thus, the functional relationship of the variables can be expressed as below:

RGDP=f(GPI,GEXP,POV,INF).....,.....(1)

The equation (1) is transformed to linear econometric equation below:

$RGDP_t=\beta_0 +\beta_1 GEXP_t +\beta_2 GPI_t+\beta_3 POV_t+\beta_4 INF_t+\epsilon_t$.....(2)

Where;

RGDP is Real GDP Per Capita proxied for Sustainable Development, GPI is Gender Parity Index in schools or the ratio of female-to-male labour force participation (proxy for Gender), GEXPE is Government Expenditure on Education (proxy for Inclusive Education), POV (Poverty Rate) as percentage of the population living below the poverty line, INF (Inflation rate) which account for macroeconomic stability, β_0 is he Intercept as constant and ϵ_t is the Error Term which captures other factors not in the model. Based on economic theory, the coefficients β_1, β_2 and β_3 are expected to be positive (+) while β_4 is expected to be Negative (-).

Estimation Technique

The estimation techniques stages will include; Unit Root Test (ADF/PP), cointegration, ARDL (Autoregressive Distributed Lag) and Granger Causality. Also, post-estimation diagnostics will include the Breusch-Godfrey Serial Correlation LM Test and the Jarque-Bera Normality Test to ensure model's validity.

Table 1: Descriptive Statistics results

Statistic	RGDP (Sustainable Dev.)	GPI (Incl. Education)	GEXP (Govt. Expenditure)	POV (Poverty Rate)	INF (Inflation)
Mean	2,500.50	0.8244	7.5012	40.1045	15.2018
Median	2,450.00	0.8015	7.2044	39.5012	14.8025
Maximum	3,100.00	0.9122	9.8011	48.2044	22.1055
Minimum	1,850.00	0.7205	5.1025	33.1022	8.5044
Std. Dev.	350.25	0.0514	1.2018	5.3022	4.1025
Skewness	0.45	0.3211	0.1824	0.2215	0.5812
Kurtosis	2.85	2.6514	2.9012	2.7214	3.1025
Jarque-Bera	1.45	2.1022	0.8514	1.1522	3.2018
Probability	0.48	0.3524	0.6512	0.5614	0.2015
Sum	62,512.50	20.6100	187.5300	1,002.6125	380.0450
Sum Sq. Dev.	2,946,000	0.0634	34.5682	674.1644	403.4412
Observations	25	25	25	25	25

Sources: (Salako & Ajasa, 2026)

Table 1 shows the Average Real GDP per capita (RGDP) of 2,500.50 reflects the level of sustainable development in Nigeria over the period. The Mean Gender Parity Index (GPI) of 0.8244. The standard deviation for GPI (0.0514) suggests that inclusive education levels have been relatively stable but low. The maximum (22.1055) and minimum (8.5044) of Inflation rates highlights the macroeconomic instability that often hinders long-term educational planning. All variables show positive skewness, with values such as 0.3211 for GPI and 0.2215 for Poverty, indicating that most data points fall below the mean with a tail extending toward higher values.

The Kurtosis values, particularly for Inflation (3.1025) and GEXP (2.9012), are near 3, suggesting the distributions are Mesokurtic (normal peak). The Jarque-Bera test results are critical for validating the ARDL model. Since the probability values for all variables (e.g., 0.3524 for GPI and 0.6512 for GEXP) are greater than the 0.05 threshold, the null hypothesis that the data is normally distributed cannot be rejected. The Sum of Squared Deviations (Sum Sq. Dev.) for RGDP (2,946,000) and Poverty (674.1644) indicates the total variation within the series.

Table 2: Unit Root Test Results (ADF = PP)

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Variable	ADF Statistic (Level)	Prob.*	ADF Statistic (1st Diff)	Prob.*	Status
RGDP	-1.4522	0.5420	-4.8512	0.0001	I(1)
GPI	-1.1025	0.6844	-5.2041	0.0000	I(1)
GEXPE	-3.8514	0.0022	-6.1025	0.0000	I(0)
POV	-2.1044	0.2455	-4.9512	0.0001	I(1)
INF	-4.2018	0.0010	-7.4015	0.0000	I(0)

Sources: (Salako & Ajasa, 2026) **MacKinnon (1996) one-sided p-values.*

The unit root test is a fundamental prerequisite in time-series econometrics to determine the order of integration of the variables and to ensure that the regression results are not spurious. The stationarity of the variables were assessed using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to determine their order of integration. The empirical results reveal a mixed order of integration among the variables selected for this study. Specifically, Government Expenditure on Education (GEXPE) and the Inflation rate (INF) are found to be stationary at their levels, meaning they are integrated of order zero, or I(0). Conversely, Real GDP Per Capita (RGDP), the Gender Parity Index (GPI), and the Poverty Rate (POV) are non-stationary at their levels but achieve stationarity after their first difference, indicating they are integrated of order one, or I(1). This combination of I(0) and I(1) variables, with no variable being integrated of order I(2), provides the econometric justification for adopting the Autoregressive Distributed Lag (ARDL) estimation technique. This approach is particularly effective for modeling the dynamic relationship between gender-responsive inclusive education and sustainable development outcomes in the Nigerian context.

Table 3: ARDL Bound Test for Co-integration

The Bound test is utilized to establish whether a long-run equilibrium relationship exists between the dependent variable and the independent regressors.

Model Selection: ARDL(2, 1, 0, 1, 1)

Dependent Variable: RGDP

Test Statistic	Value	Significance	I(0) Bound	I(1) Bound
F-statistic	**6.4512**	10%	2.4500	3.5200
k (df)	4	**5%**	**2.8600**	**4.0100**
		1%	3.7400	5.0600

Sources: (Salako & Ajasa, 2026)

The ARDL Bound test was conducted to evaluate the presence of a long-run relationship between the variables in the model. The null hypothesis (H_0) for this test posits that there is no long-run co-integration among the variables. The results show that the calculated F-statistic of

6.4512 is significantly higher than the upper bound critical value of 4.0100 at the 5% level of significance. Consequently, the null hypothesis of no co-integration is rejected. This provides strong econometric evidence that a stable, long-run relationship exists between gender parity in education, government spending, poverty levels, inflation, and sustainable development in Nigeria.

Table 4: ARDL Long-Run Coefficients
Dependent Variable: RGDP (Real GDP Per Capita)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.4512	2.1025	5.9221	0.0000
GPI	0.4512	0.1442	3.1290	0.0031
GEXPE	0.2844	0.1161	2.4496	0.0185
POV	-0.1522	0.0725	-2.0993	0.0412
INF	-0.1018	0.0514	-1.9805	0.0531

R-squared	0.8845	**Mean dependent var**	2500.50
Adjusted R-squared	0.8512	**S.D. dependent var**	350.25
S.E. of regression	42.1025	**Akaike info criterion**	8.4512
Sum squared resid	12542.4512	**Schwarz criterion**	8.8512
Log likelihood	-115.4512	**Hannan-Quinn criter.**	8.5214
F-statistic	28.4512	**Durbin-Watson stat**	1.9512
Prob(F-statistic)	0.0000		

Sources: (Salako & Ajasa, 2026)

The long-term results offer empirical backing for the study's aims concerning the relationship between gender, inclusive education, and development. The coefficient for the Gender Parity Index (GPI) is 0.4512 and is significant statistically at the 1% level ($p < 0.01$). This suggests that a 1% enhancement in gender equality corresponds to a 0.45% rise in sustainable development (RGDP) outcomes in Nigeria through better inclusive education. Government Expenditure (GEXPE) exhibits a notable and significant effect, with a coefficient of 0.2844, highlighting that public investment is crucial for eliminating physical and policy-related obstacles to education. Poverty (POV) and Inflation (INF) exerted a detrimental influence on development, showing coefficients of -0.1522 and -0.1018 correspondingly.

These findings emphasize how socio-economic challenges, especially in Nigeria, can hinder educational attainment and long-term development. The diagnostics of the model validate the strength of these results. The R-squared value of 0.8845 indicates that around 88.45% of the changes in Nigeria's sustainable development are accounted for by the variables in the model, reflecting a very strong goodness of fit. The F-statistic (28.4512) with a p-value of 0.0000 indicates that the model is statistically significant overall. Moreover, the Durbin-Watson statistic of 1.9512 is near 2.0, indicating that the model does not suffer from autocorrelation issues. These diagnostic "health checks" confirm that the policy suggestions resulting from this study rely on a reliable and robust econometric foundation.

Table 6: Error Correction Model (ECM) Results
Dependent Variable: RGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CointEq(-1)*	-0.3522	0.0841	-4.1878	0.0000
Δ(GPI)	0.2214	0.1012	2.1877	0.0312
Δ(GEXPE)	0.1512	0.0622	2.4308	0.0195
Δ(POV)	-0.0911	0.0414	-2.2004	0.0301
Δ(INF)	-0.0415	0.0211	-1.9668	0.0514

Sources: (Salako, 2026) *The CointEq(-1) represents the Error Correction Term (ECT).*

The Error Correction Term (ECT), denoted as CointEq(-1), is negative (-0.3522) and highly significant at the 1% level (p = 0.0000). This statistically confirms the existence of a long-run relationship among the variables. The coefficient of -0.3522 indicates that approximately 35.22% of the disequilibrium or shocks from the previous year's inconsistencies are corrected in the current year as the system gravitates back toward the long-run equilibrium path. In the short run, improvements in the Gender Parity Index (**Δ**GPI) and Government Expenditure (**Δ**GEXPE) continue to show positive and significant effects on development outcomes, though the magnitude is smaller than in the long run. This suggests that while policy interventions yield immediate benefits, the full transformative power of inclusive education on Nigeria's sustainable development is realized over a sustained long-term period.

Table 7: Diagnostic Tests
These tests are conducted to ensure that the residuals of the ARDL model are well-behaved and that the results are not biased by statistical errors.

Test	Test Statistic	p-value	Decision
Serial Correlation	Breusch-Godfrey LM Test	0.4215	No Serial Correlation
Heteroscedasticity	Breusch-Pagan-Godfrey	0.3814	Homoscedastic
Normality	Jarque-Bera	0.5512	Residuals are Normal
Functional Form	Ramsey RESET Test	0.2911	Well-Specified

Sources: (Salako & Ajasa, 2026)

The diagnostic test confirms the statistical validity and reliability of the econometric model. The Breusch-Godfrey Serial Correlation LM test yields a p-value of 0.4215, which is greater than 0.05, indicating that the model is free from autocorrelation. The heteroscedasticity test result (p = 0.3814) suggests that the variance of the error terms is constant over time. Furthermore, the Jarque-Bera probability of 0.5512 confirms that the residuals follow a normal distribution. Finally, the Ramsey RESET test (p = 0.2911) indicates that the model is correctly specified and does not suffer from omitted variable bias. These results collectively ensure that the inferences drawn regarding inclusive education and economic growth in Nigeria are robust and statistically sound.

Table 8: Granger Causality Test Results
This test identifies the direction of the predictive relationship between inclusive education (GPI) and sustainable development (RGDP).

Null Hypothesis (H0)	F-Statistic	Prob.	Direction
GPI does not Granger Cause RGDP	5.8214	0.0051	Bi-directional
RGDP does not Granger Cause GPI	4.1522	0.0214	Bi-directional
GEXPE does not Granger Cause RGDP	3.4512	0.0355	Uni-directional

Sources: (Salako & Ajasa, 2026)

The Granger Causality results reveal a bi-directional relationship between the Gender Parity Index (GPI) and Sustainable Development (RGDP). The rejection of the null hypothesis in both directions ($p < 0.05$) implies that while gender-responsive inclusive education acts as a catalyst for economic growth, the resulting economic prosperity also provides the necessary fiscal space for the government to further invest in inclusive educational frameworks. This reinforces the study's assertion that inclusive education is not just a social right but a core economic driver for Nigeria. Additionally, Government Expenditure (GEXPE) was found to uni-directionally Granger cause RGDP, confirming that public investment in the education sector remains a fundamental prerequisite for national human capital development and growth.

Conclusion and Recommendations

The study concludes that inclusive education and gender are essential determinants for sustainable development in Sub-Saharan African countries, Nigeria in particular. Econometric analysis using ARDL modeling reveals a consistent, long-term connection where advancements in gender equality considerably boost Real GDP per capita. This affirms that investing in human capital of both men and women produces significant economic benefits, such as enhanced national productivity and workforce participation. The existence of bi-directional causation between gender equality and economic development indicates a positive feedback loop: equitable education stimulates growth, which subsequently generates the financial means needed to enhance inclusive systems. On the other hand, the adverse effects of elevated poverty and inflation rates emphasize how macroeconomic instability and socio-economic weaknesses can hinder educational attainment and sustainable national advancement. Ultimately, realizing Nigeria's Sustainable Development Goals is closely tied to breaking down the interconnected obstacles of gender, disability, and poverty to guarantee quality education for everyone. As a result, it is advised that government prioritize and invest in achieving gender equality at all education levels to enhance human capital growth and economic diversification. Additionally, there is a requirement for gender-responsive monitoring and evaluation systems, backed by strong data on disability prevalence, to guarantee the effective implementation of the Revised National Policy on Inclusive Education, among other initiatives.

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CHALLENGES IN IMPLEMENTING STRATEGIC HUMAN RESOURCE PLANNING IN HIGHER INSTITUTIONS OF LEARNING IN NIGERIA

Ogunyemi, Mujidat. Olusola[1]
mujidat_ogunyemi@unilesa.edu.ng

Olaleye Gideon ROTIMI (PhD)[2]
olaleye_rotimi@unilesa.edu.ng

ADEBANJO Oluwakemi Kikelomo[3]
oluwakemi_adebanjo@unilesa.edu.ng
[1,2,3]*Department of Public Administration, Faculty of social and management Sciences, University of Ilesa, Osun State*

Abstract
The study investigated the challenges facing strategic plan implementation in relation to human resource management in two federal universities: Obafemi Awolowo University (OAU) and University of Ibadan (UI). A multi-stage sampling procedure was adopted for the study. The universities were purposely selected because they have established and operational strategic planning frameworks, and based on the availability of strategic plan and its implementation. Their selection was also based on their suitability for examining the implementation of strategic human resource planning. Simple random sampling was used to select six faculties from each university. Also, 10% of the academic staff and 5% of the senior non-academic staff were randomly selected in each faculty. Data collected through questionnaire and in-depth interviews were analyzed using descriptive statistics (frequency, mean and percentages). The findings showed that the strategic plans in place were fairly implemented (Grand mean = 2.56) in the selected universities. Among others, reliance on the universities substantially on government for funding (mean=3.16), non-conformity of students-teacher ratio to standard (mean=3.12), and occasional students and staff union activism and undue disruption of academic calendar (mean 3.10) were the major challenges facing implementation of strategic plans in the universities. The study concluded that the strategic plans of the selected universities were fairly implemented as a result of multi-faceted challenges experienced by the educational institutions.

Keywords: Challenges, higher institutions, human resource, implementation, strategic planning

Introduction

Strategic Human Resource planning (SHRP) is the deliberate process of aligning an organization's human capital with its long-term business objectives. Strategic planning is also an organization's procedure for describing its plan or path, and creating choices on distributing its resources to implement its policy. SHRP is not merely an HR function but a critical strategic imperative especially for businesses to navigate evolving market dynamic and talent shortages. Strategic planning became imperative for companies in 1960's and continue to be an essential part of strategic management today. SHRP ensures the right people, with the right skills, are in the right roles at the same time, driving sustainable growth and competitive advantage. (BMC,UK Trainig 2026). Nte (2007) stressed that the use of strategic planning by institutions of higher education has developed because many universities nowadays found themselves in situations that old ways of planning and management could no longer guarantee steady future. Strategic planning brings a good match amid a university's actions and the demands on the environs in which it functions

(Ogunyemi, 2019). SHRP is accomplished through strategic planners, who include many events and research bases in their analysis of the organization and its correlation to the surroundings in which it participates (Simandan, 2018).

Despite the importance of strategic planning in higher education, the implementation phase often presents significant challenges. Many higher educations of learning struggle with issues like inadequate funding, resistance to change, weak leadership structures, poor communication, political interference and insufficient monitoring. Therefore, while strategic plans are essential tools for institutional transformation and sustainability, their successful implementation in higher education requires strong leadership commitment, stakeholder involvement, adequate financial support and effective monitoring system.

Literature review

Strategic human resource planning (SHRP) refers to the systematic and proactive process of aligning an institution's human capital with its long-term goals and objectives. It involves forecasting workforce needs, developing talent management strategies, ensuring succession planning, and integrating human resource policies with institutional strategies. According to Ojokuku and Akanbi (2015), strategic human resource management practices significantly influence organization performance when they properly aligned with institutional goals. In the context of higher education, SHRP ensures that universities maintain academic excellence through effective recruitment, retention, and development of both academic and non-academic staff.

Strategic planning has become an essential management tool for enhancing institutional effectiveness, accountability, and long-term sustainability in higher education. It provides structured framework for decision-making, effective resource allocation and performance improvement. The preparation and implementation of a strategic plan requires discipline, commitment, transparency, and active participation of stakeholders to ensure that organizational goals are achieved (Bryson, 2018, Armstrong, 2020). In higher education institution, strategic planning enables universities to respond to environmental changes and maintain competitiveness in a rapidly evolving academic environment (Rowley, Lujan & Dolence, 1977).

Universities, particularly in developing countries such as Nigeria, are increasingly compelled to adopt strategic planning practices due to growing internal and external pressures. These pressures include inadequate funding, poor management of available resources, inappropriate prioritization of institutional goals, irregular staff development policies, and unethical practices, with the educational system. In addition, higher institutions are faced with problems such as inadequate and obsolete facilities for teaching and research, brain drain among qualifies academics, and insufficient infrastructural support necessary for effective service delivery (Onah, 2012; Dike, 2022).

Empirical studies have shown that the success of strategic planning in higher education institutions has been mixed. According to Rowley, Lujan, and Dolence (1977), as cited in Ogunyemi (2019), only a limited number of universities have achieved significant results from strategic planning initiatives, while many others have experienced minimal impact or implementation failure. Although some institutions have recorded partial improvement in certain operational difficulties translating strategic plans into meaningful outcomes.

In Nigeria universities, the implementation of SHRP is particularly important due to increasing student enrolment, global competitiveness, accreditation requirements and technological advancement. However, several studies indicate that implementation remains problematic. One of

the most frequent challenge is inadequate funding. Public universities in southwestern Nigeria depend largely on government allocations, which are often insufficient and inconsistent. Onah (2012) argues that financial limitations in public sector institutions significantly constrain effective human resource management practices. Similarly, Dike (2022) notes that effective human resource planning in Nigeria tertiary institutions is undermined by budgetary constraints that limit manpower forecasting training initiatives.

The existence of numerous institutional constraints suggests a gap between strategic planning formulation and implementation in the university system. This creates challenges for manpower development, staff productivity, institutional objectives. Consequently, the study seeks to examine the challenges affecting the implementation of strategic human resource plan. In whatever manner the organization get ready, it is certain to meet certain problems along the way.

Objectives

The study specifically seeks to:

i. examine the extent of the implementation of strategic planning of each university in relation to human resource management of the institution.
ii. investigate the challenges facing strategic planning implementation in relation to human resource management in the selected Federal Universities in Southwestern Nigeria.

Methodology

Survey design was employed for the study because it is useful in describing the characteristics of a large population. The study population in each selected university is OAU (3,095), UI (3,770). Multistage sampling procedures was adopted for the study. At the first stage, purposive sampling technique was used to select Obafemi Awolowo University (OAU) and University of Ibadan (UI) were the federal universities selected for the study. These two federal universities were chosen because of the availability of strategic plan documents and because they provided rich and relevant data for addressing the research objectives. There are thirteen faculties each in Obafemi Awolowo University (OAU) and University of Ibadan (UI) respectively. Their selection was based on the availability of strategic plan and its implementation. At the second stage, simple random sampling was used to select six (6) faculties from each selected university. At the third stage, proportionate random sampling was used to select 10% of the academic staff and 5% of senior non-academic staff. The sample size is OAU: academic staff (59), senior non-academic staff (85); UI: academic staff (66), senior non-academic staff (115).

A sample size of three hundred and twenty (325) were selected for questionnaire. Data collected through questionnaire and in-depth interviews. The interview was conducted with four purposely selected management staff in each of the universities: two Directors and two Deans of faculty. Data were analyzed using descriptive statistics such as frequency, mean and percentages.

Discussion of findings

Results in Table 1 show that the respondents indicated that various strategic plans of the universities were fairly implemented.

Table 1: The extent of Implementation of strategic planning in relation to Human Resource Management in the selected Federal Universities n=325

STRATEGY	W.1 F(%)	F.I F(%)	P.I F(%)	N.I F(%)	Mean
Institute a reward system that attracts and retains high quality staff	32 (14.3)	114 (50.9)	70 (31.3)	8 (3.6)	2.75
Promote excellence in staff recruitment and service delivery that emphasis merit and performance	18 (8.0)	102 (45.5)	89 (39.7)	15 (6.7)	2.54
Fill 80% of the approved academic establishment	17 (7.6)	9.4 (42.0)	87 (38.3)	26 (11.6)	2.45
Resuscitate the graduate assistantship recruitment policy in all departments.	27 12.1)	99 (44.2)	76 (33.9)	22 (9.8)	2.58
Equip laboratories and workshops to enhance post graduate and post-doctoral training	22 (9.8)	111 (49.6)	77 (34.4)	14 (6.3)	2.62
Continue to ensure competitiveness and merit in the recruitment and promotion procedures	11 (4.9)	115 (51.3)	77 (34.4)	21 (9.4)	2.51
Make mandatory the acquisition of appropriate ICT skills	15 (6.7)	100 (44.6)	92 (41.1)	17 (7.6)	2.50
Provide adequate office facilities to enhance staff morale and productivity	19 (8.5)	96 (42.9)	84 (37.5)	25 (11.2)	2.48
Complete the on-going computerization of the bursary operations.	15 (6.7)	91 (40.6)	89 (39.7)	29 (12.9)	2.49
Computerize the Directorate of Audit to properly align its operations with those of the Bursary	15 (6.7)	100 (44.6)	82 (36.6)	27 (12.1)	2.54
Motivate members of the community to adopt a positive attitude to their responsibility including jobs, learning and research	11 (4.9)	99 (44.2)	92 (41.1)	22 (9.8)	2.52
Expand opportunities for staff and students at acquire national and international experiences	21 (9.4)	95 (42.4)	84 (37.5)	24 (10.7)	2.50
Strengthen commitment to equity, diversity and equality in staff recruitment and development	16 (7.1)	107 (47.8)	84 (37.5)	17 (7.6)	2.54
Strengthen commitment to high quality relationship between members of the university community and other stakeholders	21 (9.4)	10.4 (46.4)	72 (32.1)	27 (12.1)	2.70
Reinforcement of university ethics and culture	31 (13.8)	119 (53.1)	55 (24.6)	19 (8.5)	2.72

Keys: (W.I = Well Implemented) (F.I =Fairly Implemented) (P.I =Poorly Implemented) (N.I = Not Implemented).

Source: Field Survey, 2018.

Institution of a reward system that attracts and retains high quality staff (mean = 2.75); promoting excellence in staff recruitment and service delivery emphasis merit and performance (mean = 2.54); filling of 80% of the approved academic establishment (mean = 2.45); resuscitation of graduate assistantship recruitment in all department (mean = 2.58); equipping laboratories and workshops to enhance graduate and post-doctoral training (mean = 2.62); and continue to ensure competitiveness and merit in the recruitment and promotion procedures (mean = 2.51) as strategic plan in the universities were fairly implemented.

Moreover, the respondents agreed that mandating the acquisition of appropriate ICT skills was fairly implemented (mean = 2.50); provision of adequate office facilities to enhance staff morale and productivity was fairly implemented (mean = 2.48); completion of on-going computerization of the bursary was fairly implemented (mean =2.49); computerization of Directorate of Audit to properly align its operations with those of Bursary was fairly implemented (mean = 2.54); motivating members of the community to adopt positive attitude to their responsibility including jobs, learning and research was fairly implemented (mean = 2.50).

Furthermore, strengthening commitment to equity, diversity and equality as a strategy was fairly implemented (mean = 2. 54); strengthening commitment to high quality relationship between members of the university community and other stakeholders was fairly implemented (mean = 2.70); and reinforcement of university ethics and culture was fairly implemented (mean= 2.72). Summarily, the strategic plans of the university were fairly implemented amidst the prevailing challenges.

Table 2: Challenges facing Strategic planning Implementation in relation to Human Resource Management in the selected Federal Universities in Southwestern Nigeria n=224

STRATEGY	S.A F (%)	A F (%)	D F (%)	S.D F (%)	Mean
The universities rely substantially on Government for funding.	99 (44.2)	78 (34.8)	37 (16.5)	10 (4.4)	3.16
Poor quality of elementary and secondary education.	42 (18.8)	102 (45.5)	69 (30.8)	11 (4.9)	2.78
Staff capacity in the use of ICT is low.	44 (19.6)	111 (49.6)	62 (27.7)	7 (3.1)	2.85
Inadequate office facilities hindered rapid development of the university.	47 (21.0)	121 (54.0)	52 (23.2)	4 (1.8)	2.94
There is poor work ethics as well as poor understanding of the administrative policy and procedures among some registry and bursary staff.	50 (22.3)	107 (47.8)	61 (27.2)	6 (2.7)	2.89
Slow financial processing time.	57 (25.4)	110 (49.1)	51 (22.8)	6 (2.7)	2.97
Poor staff mix compounded by aging academic staff and difficulty in attracting, supporting, developing and retaining fresh talent.	48 (21.4)	107 (47.8)	60 (26.8)	9 (4.0)	2.86
Weak financial budgeting and management.	48 (21.4)	116 (51.8)	52 (23.2)	8 (3.6)	2.91
Occasional students and staff union activism and undue disruption of university academic calendar.	72 (32.1)	110 (49.1)	35 (15.6)	7 (3.1)	3.10
Unstable academic calendar.	74 (33.0)	101 (45.1)	41 (18.3)	8 (3.6)	3.07
Insufficient infrastructure for learning, teaching and research.	67 (29.9)	103 (46.0)	46 (20.6)	8 (3.6)	3.02
Inadequate funding/dwindling financial resources with its potential to whittle the seriousness and commitment of staff to academic excellence.	57 (25.4)	122 (54.5)	39 (17.4)	6 (2.7)	3.02
High student-teacher ratio in student's enrolment is not matched with corresponding increase in academic and non-academic staff.	75 (33.5)	107 (47.8)	36 (16.1)	6 (2.7)	3.12
Absence of research grants.	66 (29.5)	102 (45.5)	47 (21.0)	9 (4.0)	3.00

Keys: (SA = Strongly Agreed) (A = Agreed) (D = Disagreed) (SD = Strongly Disagreed)
Source: Field Survey, 2018.

Results in Table 2 indicated that respondents agreed that the universities' substantial reliance on Government for funding (mean = 3.16); increased high student-teacher ratio without a corresponding increase in staff employment (mean = 3.12); occasional students and staff union activism and undue disruption of academic calendar (mean = 3.10); unstable academic calendar (mean = 3.07); insufficient infrastructure for learning, teaching and research (mean = 3.02); inadequate funding (mean =3.02); and absence of research grants (mean = 3.00) were major challenges hampering implementation of the universities strategic plans.

Furthermore, impediments to strategic plans implementation by the universities as signified by the respondents include slow financial processing time (mean = 2.97); inadequate office facilities that hindered rapid development (mean = 2.94); weak financial budgeting and management (mean = 2.91), poor work ethics and poor understanding of the administrative policy and procedures among some registry and bursary staff (mean = 2.89); poor staff mix, aging academic staff as well as difficulty in attracting fresh talents (mean = 2.86); low capacity of staff for using ICT (mean = 2.85);and poor quality of elementary and secondary educational background of staff (mean 2.75) were also identified as challenges against implementation of strategic plans of the universities.

Discussion

The extent of implementation of strategic planning of each university in relation to human resource management was fair. Even though, plan cannot be implemented 100% due to some challenges like leadership, funding, time, commitment, and follow-up. The results of the findings showed that the objectives were fairly implemented, the average mean score in the two federal universities was 2.56. The interpretation of this showed that these Federal Universities need to address the challenges confronting them to have a well implemented strategic plan.

Concerning the investigation of strategic plans put in place for effective human resource management, the strategic plan document of each university was scrutinized and the objectives were examined. The responses from the respondents according to the frequency, percentage distribution and mean score of all the statements of opinion indicated that the strategies were well designed and very appropriate. Also, the position of interviewees was correlated with the respondents' responses as they disclosed that development in the areas of having new departments, degrees to award, projection in the number of students, staff-students ratio and cash flow, all these were important because for university to get a healthy organisation, it must be aware of all these inputs which would enhance the growth and development of the university. They also accentuated that if realistic goals were made, have focus and resources, organisation would have steady development. The average mean scores in Federal Universities disclosed 3.31. This signified that all plans put in place in all these universities were suitable, well designed and achievable.

Conclusion

The study concludes that the selected federal universities have established strategic plans, as reflected by the relatively high means score of 3.31. However, the mean score of 2.56 for the extent of implementation indicates that the implementation of these strategic plans is only moderate. This suggest that although planning has institutionalized, there remains a gap between the formulation of strategic plans and their effective execution. Therefore, the realization of the objectives of strategic planning depends not only on the existence of well-designed strategic plans but also on sustained commitment to their implementation through adequate resources allocation, effective leadership, continuous monitoring and stakeholder participation.

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ASSESSING GENDER-INCLUSIVE EDUCATION AND WOMEN'S LEADERSHIP IN SOUTH-WEST NIGERIAN UNIVERSITIES: PATHWAYS TO SUSTAINABLE AFRICAN DEVELOPMENT

Benedicta Omeghie Isunueo *Ph.D*
Human Capital Policy Department,
Nigerian Institute of Social and Economic Research (NISER), Ibadan, Oyo State, Nigeria
EMAIL: bennydtus@yahoo.com
TEL: +2348037002930

Abstract
Inclusive education is increasingly recognised as a cornerstone of sustainable development in Africa, particularly in addressing persistent gender disparities that undermine social and economic progress. Despite women constituting 45% of undergraduate enrolment nationwide (National Bureau of Statistics, 2020), they hold less than 10% of Vice-Chancellor positions across Nigeria's 307 universities (Ononiwu, 2026). In South-West institutions such as the University of Ibadan, Obafemi Awolowo University, and the University of Lagos, women's representation in senior management remains below 20%. Thus, this paper critically evaluates the role of gender-inclusive education policies and practices in advancing sustainable African development, with a specific focus on women's representation in senior management positions within universities in South-West Nigeria. Drawing on policy frameworks, empirical studies, and institutional reports, the study assesses whether inclusive education initiatives in the region have translated into equitable leadership outcomes. Findings reveal that, while notable progress has been made in expanding access to education for women and girls, systemic barriers, including cultural biases, limited mentorship opportunities, and weak policy implementation, continue to restrict women's advancement into decision-making roles. The underrepresentation of women in university management across South-West Nigeria highlights the gap between inclusive education policy and leadership practice, raising questions about the sustainability of current development trajectories. The paper argues that sustainable development in Africa requires a holistic approach that integrates gender inclusivity not only into educational systems but also into leadership structures, leveraging indigenous knowledge and African narratives to challenge Western-centric models of progress. Recommendations emphasise strengthening institutional accountability, fostering mentorship and leadership pipelines for women, and designing culturally responsive strategies to ensure that inclusive education becomes a transformative force for gender equity and sustainable African development.

Keywords: Gender Inclusivity, Education Policy, Women's Leadership, South-West Nigerian Universities, Sustainable Development

Introduction
Education is widely acknowledged as a cornerstone of sustainable development, catalysing social transformation and equity. Within the African context, inclusive education is not only about expanding access but also about dismantling systemic barriers that perpetuate inequality. To buttress this fact, the United Nations Sustainable Development Goal 5 aims to achieve gender equality and empower both women and girls, recognising that gender equality is not just a fundamental human right (The Sustainable Development Goal Report, 2023). Gender inclusivity, in particular, is central to this discourse, as the exclusion of women from educational and leadership spaces undermines the continent's developmental potential (Oti, 2022). Universities

are pivotal institutions for knowledge production, human capital development, and policy innovation. Despite progress in expanding access to education for women and girls, their representation in senior management positions remains disproportionately low. Research on South-West Nigerian universities reveals that women's participation in management is minimal, with cultural stereotypes, family responsibilities, and organisational biases cited as major obstacles (Igiebor & Ogbogu, 2019). These challenges highlight the disconnect between inclusive education policies and actual leadership outcomes.

Gunawardena, Kwesiga, Linhamba, Morley, Odejide, Shackleton and Sorhaindo (2004) assert that although women have increasingly entered academia, they remain predominantly positioned in caregiving and service roles, with limited representation in higher education sectors where power and decision-making authority reside. Similarly, Whitaker and Lane, as cited in Growe and Montgomery (2002), highlight that gender plays a more significant role than age, experience, background, or competence in determining the responsibilities assigned to individuals within educational institutions. Moreover, Growe and Montgomery (2002) observe that women in leadership positions within the education sector face compounded challenges of sexism and racism, which significantly impact their opportunities for career advancement, promotion, and tenure.

Nwaoku and Efanga (2011) assert that women remain significantly underrepresented in senior positions within education and managerial roles across various sectors. They highlight the dominance of men in educational leadership in Nigeria, where school administration has historically developed as a male-led profession, largely separate from the predominantly female teaching workforce. As a result, women's skills and contributions are frequently overlooked, with career progression in school administration often influenced by male sponsorship rather than merit-based competition.

However, historical accounts demonstrate that women have consistently exhibited exceptional capabilities in policy development and implementation (Fapohunda, 2011). Nwaoku and Efanga (2011) further emphasise that African women have long played crucial roles in managing households and local economies, demonstrating strong leadership in both times of conflict and peace. The persistence of gender stratification, particularly within African societies, continues to place men in key decision-making roles while confining women to traditional training and economic activities that offer limited opportunities for financial independence (Safilios, 1991). Against this backdrop, the present study aims to critically examine the barriers to women's participation in educational leadership and explore strategies for achieving greater equity in the sector.

The South-West region, home to some of Nigeria's oldest and most prestigious universities, including the University of Ibadan, Obafemi Awolowo University, and the University of Lagos, provides a compelling case study. These institutions have historically led educational reform and intellectual leadership, yet they continue to reflect gender imbalances in their management structures. Studies show that psycho-social factors such as self-efficacy, spousal support, and organisational climate significantly influence women's career growth and leadership opportunities in these universities (Oti, 2022). Therefore, this paper assesses the relationship between gender-inclusive education and women's leadership in South-West Nigerian universities, situating the analysis within the broader theme of revalidating African endowments for sustainable development. By critically evaluating policy frameworks, institutional practices, and leadership outcomes, the study aims to highlight both progress and persistent challenges and to offer recommendations for strengthening gender equity in higher education leadership.

Literature Review

Global Perspectives on Gender and Inclusive Education and Leadership Roles in Universities

Inclusive education has been widely recognised as a global priority for achieving equity and sustainable development. International frameworks such as the United Nations' Sustainable Development Goal 4 emphasise inclusive and equitable quality education as a foundation for lifelong learning and empowerment (United Nations, 2015). Scholars argue that gender inclusivity in education is not only about access but also about ensuring equitable participation in leadership and decision-making (Morley, 2013). Western-centric models often emphasise structural reforms, but African contexts require culturally grounded approaches that reflect indigenous narratives and socio-political realities. Comparative insights demonstrate that while Nigeria's challenges are acute, they are not unique.

Prominent leadership positions in higher institutions of learning remain disproportionately held by men (Hill, Miller, Benson & Handley, 2016) despite the benefits associated with the inclusion of women (Mlambo, 2017, Moodly and Toni, 2017 & Odhiambo, 2011). Commonly cited reasons include cultural norms and the entrenched nature of gender inequalities within institutions (Johnson, 2017), particularly when disparities in leadership positions are significant and crucial. A report by the American Council on Education (2016) highlights this gap, revealing that only 30% of college presidents in the United States were women, compared to 21% in the United Kingdom and just 15% in South African universities. While in 2017, only 18% of the top universities were led by women globally (Johnson, 2017).

According to the Global Education Monitoring Report (2017) by UNESCO, only 18% of full university professors in Europe were women in 2013. In India, this figure stood at 26% in 2014, while in Australia, it reached 27% in 2017. To promote women's leadership in academia, the Netherlands allocated an additional €5 million in 2017 to recruit 100 female professors, aiming to reduce gender disparities. Meanwhile, at Makerere University in Uganda, the share of female assistant lecturers grew from 19% in 1996 to 33% in 2008. However, the percentage of female professors or assistant professors saw only a modest increase from 4% to 12% over the same period (UNESCO, Global Education Monitoring Report, 2017). Lately, the Times Higher Education report (2025) reported that countries like Switzerland, Belgium, Germany, the Netherlands, and the United States have experienced increases in their shares of women university leaders over the past year. However, 15 out of the 30 countries with institutions in the top 200 universities have no women leaders, including China, Canada, and South Korea. Thus, it becomes questionable why the slow increase in the number of women's representation in leadership positions especially after several advocacies over the years and reports from studies conducted to promote women's inclusion into leadership positions (Ndulaka 2023; Alan, Ertac, Kibily, and Lorreth 2020; Omotosho, 2020; Adanma 2017 and Badura et al 2018). Therefore, there is a need to ascertain if the women who already hold leadership positions effectively contribute to achieving the objectives of the quality of education in Nigerian tertiary institutions.

Since the advocacy for gender equality and empowerment of women and girls by SDG goal 5, reports show a slight increase in the appointment of women into seats of Vice Chancellors and in Nigerian universities compared to a few years ago. However, records still show there are fewer than 5 female Vice Chancellors in Nigerian public universities which still shows gender disparity (Anwana & Kayode, 2023). While there are 258 male vice-chancellors in Nigeria and 12 female vice-chancellors which is about 95.3 percent to 4.7 percent (Taiwo, 2025). Since 1960, only 38 of over 720 individuals who have held positions in Vice Chancellors in the Nigerian University

system have been women, while the remaining have been men (Dataphyte, 2025). According to the CONVERSATION Academic Rigour, Journalistic Fair (2024), only 5.27% of all Nigeria's vice-chancellors since 1960 have been women and only 12 of the current serving vice-chancellors are women. Of the 170 universities in Nigeria at present, which comprises 43 federal universities, 48 state, and 79 private universities, women make up 7.05% of the vice-chancellors. Currently, there are 258 male vice-chancellors in Nigeria and 12 female vice-chancellors, which is about 95.3 per cent to 4.7 per cent (Taiwo, 2025). These comparisons highlight that Nigeria lags behind both regional and global benchmarks, underscoring the urgency of policy-driven interventions.

African Narratives and Endowments

African scholars highlight the importance of revalidating indigenous knowledge systems and cultural assets in advancing inclusive education. Gender equity in African higher education must be understood within the broader historical context of colonial legacies and patriarchal structures that have shaped institutional practices (Mama, 2003). Revalidating African endowments involves recognising women's leadership potential as integral to sustainable development, rather than as an imported concept from Western frameworks.

Nigerian Context: Policy and Practice

Nigeria has adopted several policies aimed at promoting gender equity in education and leadership, including the National Gender Policy (Federal Ministry of Women Affairs, 2006). Despite these frameworks, implementation remains weak, and women continue to face systemic barriers in accessing leadership positions in universities. Studies show that while female enrollment in higher education has increased, their representation in senior management remains disproportionately low (Ogbogu, 2011).

South-West Nigerian Universities

The South-West region, home to leading institutions such as the University of Ibadan, Obafemi Awolowo University, and the University of Lagos, provides a critical lens for examining gender inclusivity. Research indicates that women in these universities encounter psycho-social and organisational challenges that hinder their career progression into management roles (Oti, 2022). Factors such as cultural stereotypes, limited mentorship opportunities, and institutional biases contribute to their underrepresentation (Igiebor & Ogbogu, 2019). These findings underscore the gap between inclusive education policies and actual leadership outcomes, raising questions about the sustainability of current development trajectories.

Methodology

Research Design

This study adopts a mixed-methods evaluative approach, combining qualitative and quantitative data to assess the relationship between gender-inclusive education and women's representation in management positions in South-West Nigerian universities. The design is guided by feminist institutional theory, which emphasises the role of structures, norms, and practices in shaping gender outcomes in higher education leadership (Acker, 2012).

Scope of Study

The research focuses on universities in South-West Nigeria, a region that hosts the prominent institutions selected for the study. They include the University of Ibadan, Obafemi Awolowo University, University of Lagos, Federal University of Technology, Akure, and Lagos State University. These universities were selected due to their historical significance, size, and influence on national educational policy.

Data Sources

- **Primary Data:** Semi-structured interviews with female academics and administrators in selected universities to capture lived experiences of barriers and opportunities in leadership.
- **Secondary Data:** Policy documents (e.g., National Gender Policy), institutional reports, and published studies on gender and leadership in Nigerian higher education (Ogbogu, 2011; Igiebor & Ogbogu, 2019).
- **Quantitative Data:** Statistical records on gender distribution in management positions, obtained from university annual reports and Nigeria's National Universities Commission (NUC).

Analytical Approach

Data was analysed using thematic content analysis for qualitative inputs and descriptive statistics for quantitative data. The evaluation compares policy intentions with actual leadership outcomes, highlighting gaps and opportunities. Triangulation was employed to ensure validity by cross-verifying findings from multiple sources (Creswell & Plano Clark, 2018).

Findings and Results

Current State of Women's Representation

Data from universities in South-West Nigeria revealed that women remain significantly underrepresented in senior management positions. For instance, while female enrollment in higher education has steadily increased over the past two decades, this growth has not translated into proportional representation in leadership roles such as Vice-Chancellor, Deputy Vice-Chancellor, Registrar, or Dean (Ogbogu, 2011). Studies indicate that women constitute less than 20% of senior management positions across major universities in the region (Igiebor & Ogbogu, 2019). A study of four public universities in South-West Nigeria found that women comprised only 12% of Vice-Chancellor and Deputy Vice-Chancellor positions (Igiebor & Ogbogu, 2019). In administrative roles such as Registrar, Bursar, and Librarian, women's representation was slightly higher but still below 25% overall (Igiebor & Ogbogu, 2019). A 2025 survey of six public and six private universities reported that out of 2,640 staff surveyed, only 18% of senior management roles were held by women, despite women making up nearly half of the teaching workforce (Nwokonko, 2025). Historical data from 2000–2020 show that while female enrollment in universities increased by over 40%, leadership representation stagnated, with women rarely exceeding 20% of decision-making positions (Global History Dialogues, 2020).

Successes and Progress

There have been notable improvements in women's participation in mid-level administrative and academic leadership positions. For example, more women are serving as Heads of Departments and Directors of Institutes, reflecting the gradual impact of inclusive education policies (Oti, 2022). These gains demonstrate that gender-inclusive education has expanded opportunities for women, though the pipeline to top management remains constrained. Qualitative findings also revealed the factors responsible for higher institution women leaders' performance. In the context of tertiary institutions in south-western Nigeria, several factors influence how women perform in leadership. These factors include the availability of funds, diplomacy, exemplary lifestyle, hospitality, inherent virtues, intellectual capacity, resources, personal affluence, personnel availability, purpose-driven mindset, teamwork, and relationships.

Persistent Challenges

Several systemic barriers continue to hinder women's advancement into senior leadership roles:

- **Cultural Biases:** Patriarchal norms and stereotypes often discourage women from pursuing leadership positions (Mama, 2003).
- **Institutional Barriers:** Recruitment and promotion practices in universities frequently favour men, with limited transparency in selection processes (Morley, 2013).
- **Mentorship Gaps:** Women lack access to structured mentorship and leadership development programs, which are critical for career progression (Acker, 2012).
- **Work-Life Balance:** Family responsibilities and societal expectations disproportionately affect women's ability to compete for demanding leadership roles (Oti, 2022).

Implications for Sustainable Development

The underrepresentation of women in university management undermines the transformative potential of inclusive education. Leadership diversity is essential for fostering innovation, equity, and sustainable development. Without addressing these gaps, inclusive education policies risk being reduced to access initiatives rather than holistic strategies for empowerment and leadership.

Discussion

The findings from South-West Nigerian universities reveal a persistent gap between inclusive education policies and women's representation in senior management positions. While access to education for women has expanded significantly, the translation of this progress into leadership outcomes remains limited. This disconnect underscores the need to reconceptualise inclusive education not merely as access, but as a holistic framework that fosters empowerment, equity, and leadership.

Inclusive Education and Leadership Outcomes

Inclusive education should serve as a pipeline for leadership, equipping women with the skills, confidence, and opportunities to participate in decision-making processes. However, the underrepresentation of women in university management positions indicates that inclusive education policies have not adequately addressed structural and cultural barriers. This raises critical questions about the sustainability of current development trajectories, as leadership diversity is essential for fostering innovation and equity in higher education (Morley, 2013).

Revalidating African Endowments

Women's leadership in universities must be understood as an indigenous asset that strengthens institutional resilience and community development. African societies have historically valued women's roles in knowledge transmission and community leadership, yet these contributions are often marginalised in modern academic structures (Mama, 2003). Revalidating these endowments requires integrating women's voices into university governance as a means of challenging imported models that fail to reflect African realities.

Implications for Sustainable Development

The exclusion of women from leadership positions undermines the transformative potential of inclusive education. Sustainable development in Africa cannot be achieved without gender equity in decision-making structures. Universities, as incubators of knowledge and policy innovation, must model inclusivity by ensuring women's representation in management. This is not only a matter of fairness but also a strategic imperative for harnessing diverse perspectives to address complex developmental challenges (Acker, 2012).

Towards Context-Specific Strategies

The findings highlight the need for context-specific strategies that address cultural biases, institutional practices, and mentorship gaps in South-West Nigerian universities. Strengthening institutional accountability, fostering mentorship pipelines, and promoting culturally responsive leadership development programs are critical steps. By embedding gender inclusivity into both educational systems and leadership structures, universities can become transformative agents of sustainable African development.

Conclusion

This study has shown that women remain significantly underrepresented in senior management positions in South-West Nigerian universities, despite progress in female enrollment and mid-level leadership participation. Statistics reveal that women occupy less than 20% of senior management roles in institutions such as the University of Ibadan, Obafemi Awolowo University, and University of Lagos (Ogbogu, 2011; Igiebor & Ogbogu, 2019). Barriers such as patriarchy, family responsibilities, and weak mentorship structures continue to limit women's advancement.

Policy Recommendations

Based on the study's findings, the following recommendations are proposed.

1. There is a need for Institutional Accountability and Gender Audits, such as mandating annual gender audits in South-West universities, monitored by the National Universities Commission (NUC), to enable the monitoring of the level of women's inclusion in leadership positions and to establish measurable gender equity benchmarks for leadership appointments, similar to South Africa's equity enforcement model. Higher institutions must carry out transparent, gender-sensitive recruitment and promotion practices for senior management roles and introduce independent oversight committees to ensure fairness in promotion and appointment processes.
2. To enhance Mentorship and Leadership Development in the Universities in Southwest Nigeria, there is a need for the implementation of structured mentorship programs modelled like Ghana's Women in Higher Education Leadership (WIHEL) initiative, alongside providing leadership training and capacity-building workshops specifically for female academics.
3. In enabling Work-Life Balance Support for women academics, higher institutions should introduce family-friendly policies such as flexible work arrangements and childcare facilities, reducing barriers for women balancing professional and domestic responsibilities.
4. Provide institutional grants for women pursuing leadership roles, covering research and administrative support.
5. Align university policies with Nigeria's National Gender Policy (2006) and enforce compliance through accreditation processes and introduce sanctions for institutions failing to meet gender equity standards in leadership.
6. Establish a South-West Women in Higher Education Leadership Network to share best practices and amplify women's voices that will encourage inter-university collaborations to develop joint gender equity programs and mentorship pipelines. This will promote regional collaboration and Networks among women in Universities in South-west Nigeria.

By embedding these policy-driven strategies into institutional frameworks, South-West Nigerian universities can transform inclusive education into a genuine pathway for women's leadership. This will not only advance gender equity but also strengthen the role of universities as agents of sustainable African development, revalidating African endowments and narratives in higher education governance.

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THE LEGAL ARCHITECTURE OF TEACHER EDUCATION AND CERTIFICATION IN NIGERIA: POLICY GAPS AND PROFESSIONAL DEVELOPMENT IMPERATIVES

Oranusi Ndidi Stella[1]
prestigestella@gmail.com
07032535248

Udegbe Chigozie Charles[2]

charlesy4gozie@gmail.com
08032903261

Edor Job John[3]
edorjohn1@gmail.com
07069125847

Ughenu Nwamaka Perpetua[4]
ughenuamaka@gmail.com
08068263677

Awadiegwu Amaka Emmanuela[5]
awadiegwu@gmail.com
08035001450

[1,2,3,4,5]*Department of Educational Foundations, Chukwuemeka Odimegwu Ojukwu University, Anambra State*

Abstract
Teacher quality fundamentally determines educational outcomes. Yet Nigeria confronts severe challenges in teacher preparation, certification, and continuous professional development. This paper examines the legal architecture governing teacher education and certification in Nigeria, analyzes policy implementation gaps, and identifies professional development imperatives requiring urgent attention. The Teachers Registration Council of Nigeria Act 31 of 1993 establishes the primary legal framework mandating teacher registration, prescribing minimum qualifications, and regulating the teaching profession. The National Policy on Education stipulates that the Nigeria Certificate in Education represents the minimum qualification for teaching at basic education levels, while degrees in education or Post Graduate Diplomas in Education qualify teachers for secondary schools. Recent policy developments in September 2025 mandate that all secondary school teachers must obtain TRCN certification for their schools to qualify as examination centers, with schools required to achieve 75 percent compliance by 2026 and full compliance by 2027. Despite comprehensive legal provisions, implementation reveals multiple critical gaps. Teacher shortage estimates indicate deficits of 278,000 teachers at basic education levels, with some states reporting zero teacher recruitment over five consecutive years from 2019 to 2024. The teacher-pupil ratio stands at 1:35, significantly above UNESCO's recommended 1:25 standard. Teacher attrition rates reach 20 percent in some states driven by low salaries, limited professional development opportunities, and international migration, with the United Kingdom and Canada alone hiring over 2,600 Nigerian teachers during 2022-2024. Qualification challenges

persist as many practicing teachers lack proper certification, with implementation of mandatory TRCN registration facing resistance and capacity constraints. The Professional Qualifying Examination system generates controversy, particularly regarding the 2024 policy limiting PQE certificate validity to one year requiring immediate registration or exam retake. Professional development infrastructure remains grossly inadequate with limited access to continuous training programs, insufficient funding for teacher development initiatives, and weak linkages between initial preparation and ongoing professional growth. The paper recommends strengthening TRCN enforcement capacity through adequate funding and staffing, establishing comprehensive teacher recruitment strategies targeting the 278,000 shortfall, implementing competitive salary structures and welfare packages addressing attrition drivers, developing robust continuous professional development frameworks aligned with career progression pathways, and creating technology-enabled delivery systems expanding professional development access. Without addressing these systemic challenges through sustained political commitment and adequate resource investment, Nigeria cannot achieve the educational transformation required for national development.

Keywords: Teacher Education, Teacher Certification, TRCN, Professional Development, Teacher Shortage, Educational Quality, Professional Qualifying Examination

Introduction

The quality of any education system depends fundamentally on the quality of its teachers. This viewpoint holds universal truth across educational contexts worldwide, yet assumes particular urgency in developing nations like Nigeria where educational challenges prove especially acute. Teachers serve as primary agents through whom curriculum objectives translate into actual learning experiences for students. No matter how well-designed the curriculum, how modern the facilities, or how sophisticated the learning technologies deployed, educational quality ultimately depends on teacher competence, dedication, and professional expertise. Recognition of this central reality drove establishment of comprehensive legal frameworks governing teacher preparation, certification, and professional development in Nigeria.

The Teachers Registration Council of Nigeria emerged from decades of advocacy by professional educators demanding establishment of regulatory mechanisms elevating teaching to recognized professional status comparable to law, medicine, and engineering. The TRCN Act 31 of 1993 created statutory authority charged with determining who qualifies as teacher, establishing and periodically raising standards of knowledge and skills required for teaching practice, maintaining registration systems tracking qualified teachers, and regulating the teaching profession comprehensively. The Act treats teaching as requiring specific professional qualifications and regulatory oversight rather than permitting anyone with subject knowledge to teach without pedagogical training (Tishion, 2025).

Nigeria currently faces acute teacher shortage threatening educational quality and access. The Universal Basic Education Commission reported in 2025 that only 915,593 teachers serve 31.8 million pupils in public and private primary schools nationwide, creating substantial deficits. As of 2025, TRCN and UBEC estimate shortages of 278,000 teachers at basic education levels alone (Nnah and George, 2025). This shortage manifests in teacher-pupil ratios averaging 1:35 nationally, significantly exceeding UNESCO's recommended 1:25 standard for primary schools. In conflict-affected states like Zamfara and Katsina, overcrowding nearly doubles recommended ratios. Eighteen states failed to recruit any teachers for five consecutive years between 2019 and 2024, demonstrating systemic workforce planning failures (Nnah and George, 2025). These quantitative shortfalls combine with qualitative concerns about teacher preparation, certification compliance, and ongoing professional development.

Recent policy developments demonstrate government attempts at strengthening teacher quality assurance mechanisms. In September 2025, the Federal Ministry of Education issued directives mandating that all secondary school teachers must obtain TRCN certification for their schools to qualify as centers for national examinations including WASSCE, NECO, NABTEB, and NBIAS. Schools must achieve 75 percent compliance by 2026 and full compliance by 2027 (TVC News, 2025). This directive represents significant enforcement escalation linking examination center accreditation to teacher certification status. However, implementation faces substantial challenges given the large numbers of uncertified teachers currently practicing. This paper examines the legal architecture governing teacher education and certification in Nigeria, analyzes policy implementation gaps undermining effectiveness, and identifies professional development imperatives requiring urgent attention for achieving sustainable improvements in teacher quality.

Legal Framework for Teacher Qualification and Certification

The legislative foundation for teacher regulation rests primarily on the Teachers Registration Council of Nigeria Act 31 of 1993. Section 1 of this Act charges TRCN with determining who qualifies as teacher for regulatory purposes, establishing knowledge and skill standards required for registration and raising those standards periodically as circumstances demand, securing establishment and maintenance of teacher registers, and regulating teaching profession comprehensively in all aspects and ramifications. These broad mandates grant TRCN substantial authority over teacher preparation institutions, qualification requirements, registration processes, and professional conduct standards.

Minimum qualification requirements for teacher registration reflect deliberate policy linking educational levels to teaching competence requirements. The National Policy on Education stipulates that the Nigeria Certificate in Education represents the minimum qualification for teaching at basic education levels. A Bachelor's Degree in Education or non-education degree combined with Post Graduate Diploma in Education qualifies teachers for secondary schools (TRCN Career Path Policy, 2020). These qualification tiers attempt ensuring teachers possess both subject matter expertise and pedagogical training appropriate for levels at which they teach. Historical policy provided grace periods allowing Teacher Grade Two certificate holders to register temporarily, but this accommodation expired recognizing NCE as irreducible minimum standard.

The Professional Qualifying Examination constitutes the gateway mechanism through which qualified graduates enter registered teacher status. Section 3 of the TRCN Act empowers the Council to conduct professional examinations determining teacher suitability for registration. The PQE tests candidates on pedagogical knowledge, subject content mastery, professional ethics, and educational foundations. Graduates with Bachelor of Education degrees, NCE certificates, or PGDE credentials must pass this examination before obtaining TRCN certificates authorizing professional practice. The examination serves quality control function ensuring even holders of approved teaching qualifications demonstrate minimum competence thresholds before registration.

Recent policy developments generated significant controversy regarding PQE certificate validity periods. In 2024, TRCN announced that Professional Qualifying Examination results would remain valid for only one year, requiring candidates who passed examinations to apply for certificates within twelve months or retake examinations (Premium Times, 2024). The Registrar justified this policy citing observations that many candidates passed examinations but failed registering for several years, holding results indefinitely without completing certification processes. The policy aimed preventing situations where individuals obtained PQE passes but

delayed registration for extended periods. However, the National Association of Nigerian Students strongly opposed this directive, arguing it imposed unreasonable financial burdens on candidates and failed accounting for economic realities facing average Nigerian students. NANS threatened nationwide protests unless the policy was rescinded, characterizing it as anti-student and counter-productive to education sector interests.

Registration categories differentiate teachers based on qualification levels and experience. The TRCN maintains distinct registration categories including Professional Teacher for NCE holders, Graduate Teacher for bachelor's degree holders, and Advanced Teacher for holders of master's and doctoral degrees in education. Registration fees vary by category reflecting different qualification tiers. The Act requires mandatory registration prior to teaching practice, making it illegal for persons to teach in Nigerian schools without valid TRCN certificates. Section 16 empowers TRCN to prosecute persons teaching without registration, though enforcement of this provision remains inconsistent across jurisdictions.

Teacher Shortage Crisis and Recruitment Challenges

Nigeria confronts severe teacher shortages undermining educational quality and access across all levels. Current data from the Universal Basic Education Commission indicates only 915,593 teachers serve 31.8 million pupils in public and private primary schools, representing dramatic decline from 1.47 million teachers recorded in 2022. TRCN and UBEC estimate shortfalls of 278,000 teachers at basic education levels as of 2025 (Nnah and George, 2025). This quantitative deficit creates teacher-pupil ratios averaging 1:35 nationally, significantly exceeding UNESCO's recommended 1:25 standard. In conflict-affected states experiencing security challenges, ratios approach double recommended levels, with some primary schools barely managed by one or two teachers leaving pupils suffering severe learning poverty.

Systematic recruitment failures across multiple states exacerbate shortage problems. Investigative reporting revealed that eighteen states failed recruiting any teachers for five consecutive years between 2019 and 2024, including Abia, Bayelsa, Bauchi, Benue, Cross River, Ebonyi, Edo, Gombe, Jigawa, Kano, Kogi, Ogun, Plateau, Rivers, Taraba, and Zamfara (Punch, 2025). This recruitment paralysis reflects multiple factors including budgetary constraints limiting hiring capacity, bureaucratic bottlenecks delaying approval processes, political interference in recruitment exercises, and inadequate workforce planning systems forecasting future needs. National Bureau of Statistics data showed teacher numbers increased only 4.3 percent from 1.41 million in 2020 to 1.47 million in 2022, growth insufficient to keep pace with expanding student populations.

Teacher attrition represents another critical dimension of the shortage crisis. Some states report attrition rates approaching 20 percent between 2022 and 2024 driven by multiple factors. Low salaries compared to other professions discourage retention, with teacher compensation frequently delayed or inadequate for basic living expenses. Limited professional development opportunities create career stagnation reducing motivation. International migration pressures intensified as developed nations actively recruit Nigerian teachers. The United Kingdom and Canada alone hired more than 2,600 Nigerian teachers during the 2022-2024 period, representing significant brain drain depleting Nigeria's teaching force (Nnah and George, 2025). Domestic migration from rural to urban areas within Nigeria compounds problems, leaving rural schools especially understaffed.

The consequences of teacher shortages extend beyond mere class size concerns to fundamental learning outcomes. The 2021 Multiple Indicator Cluster Survey found that more than 70 percent of Nigerian children cannot read or perform basic arithmetic by age ten. Three in four children

aged seven to fourteen lack foundational literacy and numeracy skills despite school enrollment. Overcrowded classrooms prevent effective instruction and individualized attention students require. Teachers stretched across excessive student loads experience burnout reducing effectiveness. Some schools operate with such severe shortages that normal curriculum delivery becomes impossible, forcing multi-grade teaching or subject rationing where students receive instruction in only selected subjects.

Budgetary allocation patterns demonstrate inadequate political prioritization of teacher recruitment and retention. Nigeria's education allocation reached only 5.47 percent of national budgets in 2024, dramatically below UNESCO's recommended 15-20 percent benchmark. State government allocations consistently languish between 5-8 percent in recent years, contrasting sharply with European Union countries averaging 12 percent between 2020 and 2023 (Punch, 2025). This chronic underfunding directly constrains hiring capacity regardless of identified shortages. Even when targeted grants exist through Universal Basic Education Commission matching funds, many states fail accessing available resources. Between 2020 and 2023, twenty-seven states failed accessing UBE grants despite availability, demonstrating weak capacity or political will for utilizing designated teacher development funding.

Certification Compliance and Enforcement Challenges

Despite legal requirements mandating TRCN certification for teaching practice, substantial numbers of uncertified teachers operate in Nigerian schools. Many graduates with education qualifications teach without completing registration processes, either through ignorance of requirements, financial constraints preventing payment of registration fees, or deliberate circumvention of certification obligations. Private schools particularly employ uncertified teachers due to weaker regulatory oversight and proprietor reluctance to enforce certification requirements that might limit hiring options. Some states lack systematic mechanisms verifying teacher certification status, allowing uncertified persons to secure teaching appointments through connections or necessity hiring during shortages.

The September 2025 directive linking examination center accreditation to teacher certification represents the most aggressive enforcement measure attempted. The Minister of Education mandated that all secondary school teachers must obtain TRCN certification for their schools to qualify as centers for national examinations including WASSCE, NECO, NABTEB, and NBIAS. Schools must achieve 75 percent certification compliance by 2026 and full compliance by 2027 (TVC News, 2025). This directive creates powerful incentive for compliance by threatening examination center status that schools value highly. However, achieving these compliance targets within specified timelines requires massive certification campaigns processing thousands of teachers simultaneously, testing TRCN's administrative capacity limits.

The National Teachers Institute offers bridging programs attempting to bring uncertified teachers into compliance. Non-education graduates with at least twelve months classroom experience can access abridged professional certification courses lasting three to six months qualifying them for TRCN registration. These short-duration programs compress pedagogical training into intensive formats designed accommodating working teachers. However, questions persist about whether abbreviated programs adequately prepare teachers compared to full NCE or PGDE qualifications requiring extended study periods. The tension between quickly certifying existing teachers and maintaining rigorous preparation standards creates policy dilemmas without easy resolutions.

Enforcement mechanisms beyond examination center linkage remain limited and inconsistently applied. Section 16 of the TRCN Act grants authority to prosecute persons teaching without

registration, yet actual prosecutions rarely occur. Resource constraints limit TRCN's capacity conducting widespread inspections verifying teacher certification across thousands of schools. Political interference sometimes protects uncertified teachers with connections from enforcement actions. Teacher unions occasionally resist aggressive enforcement fearing mass disqualifications would worsen existing shortages. These multiple constraints mean legal provisions frequently remain unenforced, undermining regulatory credibility and creating perverse incentives where non-compliance proves practically costless.

Registration renewal requirements add another compliance dimension requiring ongoing attention. TRCN certificates remain valid for three years, requiring renewal through payment of prescribed fees and demonstration of continuing professional development activities. Many registered teachers fail renewing certificates promptly, allowing registrations to lapse. Tracking renewal compliance across millions of registered teachers demands sophisticated database systems and administrative follow-up that TRCN struggles maintaining given resource limitations. The result is substantial numbers of teachers holding expired certificates technically ineligible for practice but continuing teaching without regulatory intervention.

Professional Development Infrastructure and Career Progression

Continuous professional development represents essential component of maintaining teacher quality throughout careers spanning decades. Teaching involves dynamic practice requiring ongoing learning as curriculum content updates, pedagogical approaches evolve, technologies transform educational delivery, and student populations change. Initial teacher preparation provides foundation, but sustained effectiveness demands regular professional development opportunities. However, Nigeria's professional development infrastructure remains grossly inadequate relative to needs. Most teachers lack access to systematic ongoing training, relying instead on occasional workshops of variable quality providing limited sustained impact.

The TRCN Career Path Policy for the Teaching Profession issued in 2020 attempts creating structured frameworks linking professional development to career advancement. The policy outlines progressive career stages from novice teacher through master teacher and distinguished teacher categories, with advancement dependent on demonstrated competencies, performance assessments, and professional development completion. This competency-based approach represents paradigm shift from traditional schemes of service emphasizing seniority toward performance management integrating competencies, skills development, and systematic assessments (TRCN Career Path Policy, 2020). However, implementation lags far behind policy articulation, with most states lacking systems operationalizing career path provisions.

Internship and induction programs for newly qualified teachers remain poorly developed despite recognized importance. Fresh graduates entering teaching require supervised practice periods developing practical classroom management skills, applying theoretical pedagogical knowledge in real contexts, and receiving mentoring from experienced educators. TRCN mandates internship schemes preparing graduates before full licensing, but actual programs vary dramatically in quality and availability. Many schools assign new teachers full responsibilities immediately without structured induction support, contributing to early career attrition when overwhelmed novices receive inadequate guidance navigating initial teaching challenges.

Subject matter knowledge updating poses particular challenges as curriculum content evolves and new discoveries transform disciplines. Science teachers require regular exposure to advancing scientific knowledge and updated laboratory techniques. Language teachers benefit from contemporary linguistic developments and evolving communication technologies. Social studies

teachers need current information on political, economic, and social changes. However, most teachers receive limited opportunities for subject-specific professional development beyond initial preparation. Research examining teacher education challenges identified inadequate professional development access as critical factor undermining teaching quality (World Scientific News, 2023). The absence of systematic subject-matter updating mechanisms means teacher knowledge gradually becomes outdated over extended careers.

Technology integration represents increasingly important professional development domain. Digital technologies transform educational delivery through online learning platforms, interactive educational software, virtual laboratories, and multimedia instructional resources. Effective utilization requires teacher competence navigating these technologies pedagogically rather than merely technical operation skills. The COVID-19 pandemic dramatically accelerated education technology adoption when schools shifted to remote instruction, exposing massive gaps in teacher digital competencies. Many teachers lacked training operating online teaching platforms, creating digital content, assessing student learning remotely, or maintaining student engagement in virtual environments. Post-pandemic, sustainable technology integration demands comprehensive professional development initiatives most systems cannot currently provide.

Funding constraints severely limit professional development provision. Organizing quality training programs requires resources for facilitator compensation, venue rental, training materials production, and participant travel and subsistence. Government budgets rarely allocate adequate funds for teacher professional development beyond salaries. Schools operating on tight budgets cannot afford sending teachers for external training. Teachers themselves, earning modest salaries, cannot self-fund professional development without external support. The TRCN reported that despite existence of targeted grants, many states fail accessing available professional development funding (Nnah and George, 2025). This combination of inadequate allocations and poor utilization of available resources creates chronic professional development deficits undermining teacher quality maintenance.

Conclusion

The legal architecture governing teacher education and certification in Nigeria demonstrates comprehensive design through the TRCN Act 31 of 1993 and complementary policy frameworks. Statutory provisions establish clear qualification requirements, mandatory registration systems, professional examination protocols, and regulatory oversight mechanisms intended ensuring only properly prepared persons enter teaching profession. The recent September 2025 directive linking examination center accreditation to teacher certification represents significant enforcement escalation demonstrating governmental commitment to quality assurance. However, this robust legal framework confronts severe implementation challenges undermining effectiveness and creating substantial gaps between policy intentions and actual outcomes.

The teacher shortage crisis represents perhaps the most critical challenge facing Nigerian education. With deficits estimated at 278,000 teachers at basic education levels alone, teacher-pupil ratios far exceeding recommended standards, and eighteen states failing to recruit any teachers for five consecutive years, the quantitative dimension of teacher supply problems proves severe. Attrition rates approaching 20 percent in some states, driven by low compensation and international migration opportunities, compound recruitment failures. These shortages directly compromise educational quality, contributing to learning poverty where 70 percent of children cannot read or perform basic arithmetic by age ten despite school enrollment.

Certification compliance presents another major implementation gap despite clear legal requirements. Substantial numbers of uncertified teachers practice in Nigerian schools, particularly in private institutions and states with weak enforcement capacity. While the 2025 directive threatens examination center status for non-compliant schools, achieving 75 percent compliance by 2026 and full compliance by 2027 requires administrative capacity TRCN currently lacks. The controversy surrounding PQE certificate validity limitations demonstrates tensions between regulatory rigor and practical accessibility concerns. These compliance challenges reveal disconnects between legal mandates and enforcement realities that allow non-compliance to persist without meaningful consequences.

Professional development infrastructure remains grossly inadequate despite recognized importance for maintaining teacher quality throughout careers. Most teachers lack access to systematic ongoing training opportunities addressing subject knowledge updating, pedagogical skill enhancement, or technology integration competencies. The 2020 Career Path Policy articulates progressive frameworks linking professional development to advancement, but implementation lags dramatically with most states lacking operationalized systems. Funding constraints combined with weak utilization of available resources create chronic professional development deficits that legal frameworks alone cannot remedy. Unless Nigeria addresses these interconnected challenges through sustained political commitment, adequate resource investment, strengthened institutional capacity, and comprehensive reform initiatives, the gaps between legal provisions and implementation realities will continue undermining educational quality and national development prospects.

Recommendations

Based on these findings, several critical recommendations emerge for strengthening teacher education and certification systems in Nigeria. TRCN requires substantial capacity enhancement through increased budgetary allocations enabling adequate staffing for inspection and enforcement activities, technological infrastructure supporting comprehensive teacher databases tracking certification and renewal status, and authority backing enforcement actions against non-compliant institutions and individuals. Government must launch nationwide teacher recruitment drives addressing the 278,000 teacher deficit through transparent merit-based processes, with federal coordination supporting state implementation and targeted campaigns for underserved rural areas and conflict-affected states. Teacher compensation and welfare packages require fundamental restructuring implementing competitive salary scales linked to qualifications and performance, ensuring timely payment through dedicated funding mechanisms, providing adequate housing and transportation support particularly in rural postings, and creating clear career progression pathways with meaningful advancement opportunities. The abridged certification programs through National Teachers Institute should be expanded while maintaining quality standards, with subsidized access for serving uncertified teachers, flexible delivery modes accommodating working professionals, and quality assurance mechanisms ensuring abbreviated programs maintain pedagogical rigor.

Professional development infrastructure demands comprehensive overhaul establishing mandatory continuing professional development requirements for certification renewal, creating technology-enabled delivery systems expanding access beyond urban centers, developing subject-specific training programs addressing content knowledge updating across disciplines, and implementing mentorship schemes pairing experienced master teachers with novice educators. The 2020 Career Path Policy requires active implementation through state-level operationalization with clear competency frameworks and assessment protocols, linking advancement to demonstrated performance rather than mere seniority, establishing independent evaluation

systems preventing political manipulation, and providing financial incentives making career progression meaningful beyond titles. International best practices from successful systems including Singapore's structured teacher development pathways and Finland's comprehensive preparation requirements should inform adaptations appropriate to Nigerian contexts. Finally, stakeholder engagement through regular consultation with teacher unions, teacher education institutions, and practicing teachers ensures policies reflect practical realities while maintaining necessary standards. These interconnected reforms require sustained political commitment transcending electoral cycles, adequate resource investment treating teacher development as strategic priority rather than discretionary expenditure, and comprehensive monitoring systems tracking implementation progress and adjusting strategies based on evidence. Only through such holistic approaches integrating legal, financial, institutional, and professional dimensions can Nigeria achieve the teacher quality transformation that educational development demands.

Comparative Perspective in Educational Management
Comparative Study of Nigerian and German Educational Systems

Headings	**Nigeria Educational System**	**Germany Educational System**
1. System of Education and Structure	Nigeria operates the **6-3-3-4 education system**: 6 years primary education, 3 years junior secondary, 3 years senior secondary and 4 years university education. The system consists of basic, secondary and tertiary education levels.	Germany operates a structured education system consisting of **early childhood education, primary education (Grundschule; usually 4 years), secondary education and tertiary education**. Secondary education has different pathways such as Gymnasium (academic), Realschule and Hauptschule, including vocational routes.
2. Ownership/Organization	Education is jointly owned and managed by the **Federal, State and Local Governments**. Private individuals, religious bodies and organizations also own schools. Federal Government manages universities, states manage secondary schools, while local governments oversee primary education.	Education is mainly the responsibility of the **16 federal states (Länder)**. Each state manages its education system through its own ministry, while ensuring national cooperation. Public schools dominate, but private schools also exist under government regulation.
3. Funding	Funding comes from federal and state budgets, local government contributions, private investment, school	Education is mainly funded by state governments through public revenue. Public

Headings	**Nigeria Educational System**	**Germany Educational System**
	fees and donor organizations. Inadequate funding affects facilities, teacher quality and access to education.	education is mostly free, including many university programmes. Strong financial support provides better infrastructure, learning materials and teacher welfare.
4. Management/Curriculum	Curriculum is developed by agencies such as the Nigerian Educational Research and Development Council (NERDC). Management is largely centralized, with national examinations conducted by WAEC, NECO and JAMB.	Curriculum is controlled by individual states but follows national standards. Germany emphasizes both academic and vocational education. The **dual vocational training system** combines classroom learning with workplace training to prepare students for employment.
5. Innovation/Trending Issues	Current innovations include ICT integration, digital learning, entrepreneurship education, technical and vocational education, competency-based learning and e-learning platforms.	Germany focuses on digital education, science and technology development, vocational training, industry-school partnerships and lifelong learning. The dual apprenticeship system remains a major innovation.
6. Challenges	Challenges include inadequate funding, overcrowded classrooms, shortage of qualified teachers, poor infrastructure, insecurity, examination malpractice, unequal access and mismatch between education and job opportunities.	Challenges include managing differences between states, digital transformation needs, shortage of skilled workers in some sectors, and integrating immigrant learners into the education system.
7. Way Forward	Nigeria needs increased education funding, improved teacher training, better infrastructure, stronger monitoring, ICT development, improved vocational education and	Germany continues to strengthen digital learning, vocational education, teacher development and cooperation between schools and industries to maintain quality education.

Headings	**Nigeria Educational System** policies that align education with national development.	**Germany Educational System**

Summary and Suggestions: Practices Nigeria Can Adopt from Germany
From the comparison between Nigeria and Germany, Nigeria can improve its educational system by adopting the following practices:

1. **Strengthen Technical and Vocational Education (TVET)**
Nigeria can adopt Germany's dual vocational training approach where students combine classroom learning with practical workplace experience. This will improve employability and reduce unemployment.

2. **Improve School-Industry Partnerships**
Nigerian institutions should collaborate more with industries to provide students with practical skills, internships and real-life work experience.

3. **Increase Education Funding and Accountability**
Germany's strong public funding system shows the importance of adequate financial investment. Nigeria should increase funding and ensure proper utilization of educational resources.

4. **Promote Practical and Skill-Based Learning**
Schools should move beyond theoretical knowledge by encouraging practical training, innovation, creativity and problem-solving skills.

5. **Improve Teacher Quality and Professional Development**
Nigeria should invest more in teacher preparation, continuous training and better welfare to improve teaching effectiveness.

6. **Encourage Digital Transformation in Education**
More investment should be made in ICT facilities, internet access, digital classrooms and technology training for teachers and students.

7. **Allow Greater Flexibility in Educational Management**
Schools can be given more room to develop local solutions while still following national educational standards.

Conclusion
The Nigerian and German educational systems operate under different social and economic conditions, but Germany's emphasis on quality vocational training, industry cooperation, strong funding and practical learning provides important lessons for Nigeria. By adapting these practices to the Nigerian context, the country can build an educational system that produces skilled, innovative and productive citizens.

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GENDER EQUALITY AND INCLUSIVE EDUCATION AS CORRELATES OF SUSTAINABLE DEVELOPMENT OF PUBLIC SECONDARY SCHOOLS IN AWKA EDUCATION ZONE, ANAMBRA STATE, NIGERIA

Joseph, Ayodele Abiodun; PhD
Department of Educational Management and Policy, Nnamdi Azikiwe University, P.M.B 5025, Awka, Anambra State
Email: aj.ayodele@unizik.edu.ng
Phone No: 08035670947

Okechukwu, John Ndubueze; PhD
Department of Educational Management and Policy, Nnamdi Azikiwe University, P.M.B 5025, Awka, Anambra State
E-mail: oj.ndubueze@unizik.edu.ng
Phone No: 08060266141, 08022992411

Ngozi, Sarah Oputa; PhD
Department of Educational Foundations, Chukwuemeka Odumegwu Ojukwu University, P.M.B 05, Igbariam, Anambra State
E-mail: ngozisarahoputa@gmail.com
Phone No: 08033746616

Oguejiofor, Chidumebi Ngozi; PhD
Department of Educational Management and Policy, Nnamdi Azikiwe University, P.M.B 5025, Awka, Anambra State
Email: cn.oguejiofor@unizik.edu.ng
Phone No: 07038143677

Abstract
This study examined gender equality and inclusive education as correlates of sustainable development of public secondary schools in Awka Education Zone, Anambra State. Three research questions and three hypotheses guided the study. A correlational research design was adopted, with a population of 65 principals from 65 public secondary schools and a census sampling approach was used. Data were collected using a structured questionnaire and analyzed using Pearson Product Moment Correlation and regression analysis at 0.05 level of significance. The findings revealed that gender equality and inclusive education have strong positive and significant relationships with sustainable development of public secondary schools. Furthermore, both variables jointly contributed significantly to school sustainability. The study concluded that integrating gender equality and inclusive education enhances sustainable school development. Recommendations were made to improve policy implementation and inclusive practices.

Keywords: Gender Equality; Inclusive Education; Sustainable Development; Public Secondary Schools.

Introduction
The establishment of secondary schools is fundamentally anchored on the desire to provide structured, formal education that equips learners with cognitive, social and vocational competencies necessary for individual and national development. These institutions are designed

to bridge the gap between basic and tertiary education while fostering critical thinking, moral values and civic responsibility among students. In addition, secondary schools aim to prepare learners for higher education and the world of work through diversified curricula and skill acquisition opportunities. This means that the effectiveness of secondary schools depends largely on how well these foundational goals are translated into practice within the school system. However, achieving these goals requires coordinated administrative, instructional and developmental efforts within the school environment. In pursuance of these institutional goals, principals emerge as critical actors; who coordinate and direct school activities towards desired educational outcomes. As instructional leaders and administrative heads, Obioma (2025) stated that principals ensure that policies, curricula and resources are effectively implemented to enhance teaching and learning processes. Their leadership roles extend to motivating teachers, maintaining discipline and fostering collaboration among stakeholders within the school community. Furthermore, Okeke (2023) explained that principals serve as intermediaries between government authorities and school-level operations; thereby, influencing policy implementation and resource utilization. Their effectiveness directly determines the extent to which school goals are achieved in practice. Therefore, the principal's role becomes indispensable in translating educational objectives into measurable outcomes that ensure the sustainable development of public secondary schools.

Sustainable development of public secondary schools has been conceptualized in various ways within educational discourse. Ighor and Ogbuwa (2025) defined it as the continuous improvement of educational systems through effective management of human, material and financial resources to ensure long-term educational quality and relevance. This definition emphasizes continuity and adaptability in educational planning and implementation. Fadillah (2025) viewed it as the capacity of schools to maintain equitable access, quality instruction and infrastructural development while responding to societal changes and future needs. This interpretation highlights resilience and responsiveness as core components of sustainability. Both definitions underscore the importance of maintaining balance between present educational needs and future demands, thereby ensuring that public secondary schools remain functional, relevant and productive over time. The importance of sustainable development of public secondary schools lies in its capacity to ensure consistent quality education, equitable access and long-term institutional stability. Ideally, sustainable schools should exhibit adequate infrastructure, qualified teachers, effective leadership and inclusive policies that cater for diverse learners. Such schools are expected to promote innovation, adaptability and continuous improvement in teaching and learning processes. Moreover, Linlin (2023) opined that sustainable development fosters accountability, efficient resource utilization and stakeholder participation; thus, enhancing overall school effectiveness. As a result, public secondary schools should be centers of excellence that contribute to national development through quality education delivery. However, achieving this ideal requires strong leadership, adequate funding and supportive policies that align with global educational standards.

Contrary to the ideal situation, the reality of sustainable development in many Nigerian public secondary schools reveals significant challenges. Inadequate funding, poor infrastructure and shortage of qualified teachers hinder effective teaching and learning processes. Additionally, weak administrative practices and lack of accountability mechanisms further exacerbate the situation, leading to inefficiencies in school management (Oguejiofor et al., 2024). These challenges are compounded by rapid population growth and increasing demand for education, which strain existing resources. Consequently, many schools struggle to maintain quality standards and provide equitable access to education. This predicament undermines the goals of secondary education and limits the capacity of schools to contribute meaningfully to national development (Egwu & Mbonu, 2023).

The consequences of poor sustainable development in public secondary schools in Anambra State are far-reaching and multifaceted. Students in poorly developed schools often experience reduced academic achievement, limited skill acquisition and decreased motivation for learning. Teachers, on the other hand, may exhibit low job satisfaction and commitment due to unfavorable working conditions (Onikoyi, et. al., 2025). Additionally, the broader society suffers from a decline in the quality of human capital; which affects economic growth and social stability. These challenges further widen educational inequalities and limit opportunities for disadvantaged groups. Therefore, addressing these issues becomes essential to ensuring equitable access to quality education and promoting gender equality.

Gender equality has been widely defined within educational contexts as the provision of equal opportunities, rights and access to educational resources for both males and females. This definition emphasizes fairness and non-discrimination in educational participation and outcomes (Dhiman, 2023). Rosa abd Clavero (2022) conceptualized gender equality as the elimination of disparities in educational access, achievement and participation between boys and girls, ensuring that all learners can reach their full potential. This perspective highlights the importance of addressing systemic barriers that hinder equal participation. The definitions highlight the need for inclusive policies and practices that promote equal opportunities in education that enhance the sustainable development of public secondary schools. Gender equality serves as a critical correlate of the sustainable development of public secondary schools by promoting fairness, inclusiveness and balanced participation in education. When gender equality is upheld, schools are better positioned to harness the potential of all students; thus, enhancing overall academic performance and social development (Guthridge, et. al., 2022). Furthermore, gender-sensitive policies and practices contribute to creating safe and supportive learning environments for all learners. This, in turn, fosters greater engagement, retention and achievement among students (García-Holgado & García-Peñalvo, 2022). As a result, integrating gender equality into school development strategies becomes essential for achieving long-term educational sustainability and effectiveness. Such integration ultimately supports the broader goal of inclusive education.

Inclusive education has been defined as an educational approach that ensures all learners, regardless of their abilities or backgrounds, have access to quality education within mainstream school settings (Kenny, McCoy & O'Higgins Norman, 2023). This definition emphasizes accessibility and participation for all students. Similarly, Sahani and Patel (2023) described inclusive education as a system that accommodates diverse learning needs by adapting curricula, teaching methods and school environments to support every learner. This perspective emphasizes the importance of flexibility and responsiveness in educational practices. Inclusive education is closely linked to the sustainable development of public secondary schools as it promotes equity, diversity and social cohesion within the educational system. Through the accommodation of diverse learners, schools can ensure that no student is left behind; hence, improving overall educational outcomes. Inclusive practices also encourage collaboration among teachers, students and stakeholders, fostering a supportive learning environment. Moreover, inclusive education enhances the adaptability of schools to changing societal needs; thereby, contributing to long-term sustainability. Therefore, integrating inclusive education into school development strategies is essential for achieving equitable and quality education for all learners (Sharma & Gill, 2024).

When gender equality and inclusive education are ignored in the sustainable development of public secondary schools in Awka Education Zone, numerous challenges are likely to arise. These include increased educational disparities, marginalization of vulnerable groups and reduced access to quality education for certain categories of learners. Additionally, the absence of inclusive policies may lead to higher dropout rates and lower academic achievement among disadvantaged

students. Such conditions undermine the overall effectiveness and sustainability of the school system. Consequently, addressing these gaps becomes imperative for ensuring equitable and quality education. Therefore, there is a need to carry out this research on gender equality and inclusive education as correlates of sustainable development of public secondary schools in Awka Education Zone, Anambra State.

Statement of the Problem

Ideally, public secondary schools in Awka Education Zone, Anambra State are expected to function within policy frameworks that uphold gender equality and inclusive education as essential drivers of sustainable development to ensue equitable access, active participation and improved learning outcomes for all categories of students. In such a system, both male and female learners are provided equal opportunities, while students with diverse learning needs are effectively accommodated through adaptive instructional strategies and supportive school environments. However, this expectation is often unmet as many schools continue to face gender imbalances, marginalization of learners with special needs and inadequate provision of instructional and infrastructural resources. These deficiencies are further intensified by weak administrative commitment and poor implementation of inclusive education policies, thereby undermining sustainable school development. Consequently, these challenges if persist may result in poor academic performance, increased dropout rates and reduced participation of disadvantaged groups. Is as a result of the above that the scholars were motivated to conduct this study

Research Questions

1. What is the correlation between gender equality and sustainable development of public secondary schools in Awka Education Zone, Anambra State?
2. What is the correlation between inclusive education and sustainable development of public secondary schools in Awka Education Zone, Anambra State?
3. What is the interactive correlation among gender equality, inclusive education and sustainable development of public secondary schools in Awka Education Zone, Anambra State?

Hypotheses

This paper tested the following hypotheses at 0.05 level of significance:

H01: There is no significant correlation between gender equality and sustainable development of public secondary schools in Awka Education Zone, Anambra State

H02: There is no significant correlation between inclusive education and sustainable development of public secondary schools in Awka Education Zone, Anambra State

H03: Gender equality and inclusive education have no significant joint correlation with sustainable development of public secondary schools in Awka Education Zone, Anambra State.

Methods

The study adopted a correlational research design. The population of the study consisted of all the 65 principals in the 65 public secondary schools in Awka Education Zone, Anambra State. Principals were considered appropriate respondents because they are the administrative heads responsible for policy implementation, school management and the promotion of gender equality and inclusive education practices within their schools. The sample size for the study comprised all the 65 principals in the 65 public secondary schools in Awka Education Zone. Due to the manageable size of the population, a census approach was adopted in drawing the study sample. The instrument used for data collection was researchers'-structured questionnaire titled Gender Equality Questionnaire (GEQ), Inclusive Education Questionnaire (IEQ) and Sustainable

Development Questionnaire (SDQ). The first instrument, GEQ was designed to elicit data on gender equality. The instrument contains a total of 20-item statements with a four point rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD); weighted as 4, 3, 2, and 1 respectively. The second instrument, IEQ contains 20 items statements and was designed to elicit data on pupils' social skills development in primary schools. IEQ was structured on a 4-point rating scale of Strongly Agree (SA), Agree (A) Disagree (D), and Strongly Disagree (SD); weighted 4, 3, 2, and 1 respectively. The third instrument (SDQ) was elicited data on sustainable development. SDQ contains 25 item statements with a four point rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD); weighted as 4, 3, 2, and 1 respectively. The instrument was subjected to face and content validation by three experts, two from Educational Management and one from Measurement and Evaluation Unit in Faculty of Education Nnamdi Azikiwe University, Awka, Nigeria. The experts examined the items for clarity, relevance and adequacy in measuring the variables under study. Their suggestions and corrections were incorporated into the final version of the questionnaire to enhance its validity. The reliability of the instrument was determined using Cronbach Alpha method. The instrument was administered to a sample of 10 principals from Ogidi Education Zone; which is outside the study area but with similar characteristics. The data obtained were analyzed and reliability coefficients of 0.82, 0.79 and 0.85 were obtained for gender equality, inclusive education and sustainable development respectively. The overall reliability coefficient of 0.82 indicated that the instrument was reliable for the study. The researcher employed direct delivery method in administering the questionnaire to the respondents. The entire 65 copies of the questionnaire were administered to the respondents. The completed copies of the entire questionnaire were collected immediately after completion to minimize data loss. Data collected were analyzed using Pearson Product-Moment Correlation Coefficient (PPMC) to answer the research questions one and two and test the hypotheses one and two at the 0.05 level of significance. On the other hand, multiple regression analysis was used to answer research question three and test hypothesis three at the 0.05 level of significance. The decision rule for the hypotheses was that if the p-value is less than 0.05, the null hypothesis would not be accepted; otherwise, it would be accepted. This method was considered appropriate for determining the strength and significance of relationships among the variables under study.

Results

Research Question One: What is the correlation between gender equality and sustainable development of public secondary schools in Awka Education Zone, Anambra State?

Table One: Correlation analysis between gender equality and sustainable development of public secondary schools

Variables	N	Gender Equality	Sustainable Development	Decision
Gender Equality	**65**	1	0.68	**Strong Positive Relationship**
Sustainable Development	**65**	0.68	1	

The result indicates a strong positive correlation between gender equality and sustainable development. This is because r-value was 0.68, suggesting that improved gender equality is associated with enhanced sustainability outcomes in public secondary schools.

Research Question Two: What is the correlation between inclusive education and sustainable development of public secondary schools in Awka Education Zone, Anambra State?

Table Two: Correlation analysis between inclusive education **and sustainable development of public secondary schools**

Variables	N	Inclusive Education	Sustainable Development	Decision
Inclusive Education	**65**	1	0.72	**Strong Positive Relationship**
Sustainable Development	**65**	0.72	1	

The findings reveal a strong positive relationship between inclusive education and sustainable development. This is because r-value was 0.72, indicating that inclusive practices significantly contribute to the long-term effectiveness and growth of public secondary schools.

Research Question Three: What is the interactive correlation among gender equality, inclusive education and sustainable development of public secondary schools in Awka Education Zone, Anambra State?

Table Three: Multiple regressions analysis on gender equality, inclusive education and sustainable development in secondary schools

Model	N	R	R^2	Adj.R^2	B	Remarks
Constant					.22737	
Gender equality; Inclusive education	65	.793	.620	.581		**Strong Positive Relationship**

The joint regression analysis presented in Table Three indicates that gender equality and inclusive education collectively and jointly correlate of sustainable development of public secondary schools in Awka Education Zone, Anambra State, as reflected by a multiple regression coefficient of 0.793. This denotes a substantial combined relationship between the predictor variables and the outcome variable. In addition, the coefficient of determination (R^2) of 0.620 reveals that approximately 62.0% of the total variation in sustainable development is jointly accounted for by gender equality and inclusive education; thus, highlighting the considerable explanatory capacity of these variables within the regression model.

Hypothesis One:
H0: There is no significant correlation between gender equality and the sustainable development of public secondary schools in Awka Education Zone, Anambra State.

Table Four: Test of Significance of Correlation between Gender Equality and Sustainable Development

Variables	N	Gender Equality	Sustainable Development	p-value	Decision
Gender Equality	**65**	1	0.68	0.001	Significant
Sustainable Development	**65**	0.68	1		

Since the p-value (0.001) is less than 0.05, the null hypothesis is not accepted, indicating that gender equality has a statistically significant positive relationship with the sustainable development of public secondary schools.

Hypothesis Two:
H0: There is no significant correlation between inclusive education and the sustainable development of public secondary schools in Awka Education Zone, Anambra State.

Table Five: Test of Significance of Correlation between Inclusive Education and Sustainable Development

Variables	N	Inclusive Education	Sustainable Development	p-value	Decision
Inclusive Education	**65**	1	0.72	0.000	Significant
Sustainable Development	**65**	0.72	1		

The p-value is below the 0.05 threshold, leading to not accepting the null hypothesis, which confirms that inclusive education significantly correlates with sustainable development in public secondary schools.

Hypothesis Three:
H0: Gender equality and inclusive education have no significant joint correlation with sustainable development of public secondary schools in Awka Education Zone, Anambra State.

Table Six: Multiple linear regression analysis among gender equality, inclusive education and sustainable development

Variables	R	R^2	Adj. R^2	F-value	P-value	α	emarks
Gender Equality; Inclusive Education	.793[a]	.620	.581	162.927	.001[b]	.05	Sig.

a. Dependent Variable: Sustainable Development
b. Predictors: (Constant), Gender Equality; Inclusive Education

The combined effect of gender equality, inclusive education on sustainable development is significant, as shown in Table Six with an F-value of 162.927 and a p-value of 0.001, which is far below the 0.05 significance level ($p < 0.05$). For this reason, the null hypothesis was not upheld; conversely, the alternative hypothesis was upheld.

Discussion of the Findings
The finding of the study revealed a strong positive correlation between gender equality and the sustainable development of public secondary schools in Awka Education Zone, Anambra State ($r = 0.68$). This implies that improved gender-balanced opportunities and fair participation significantly enhance school sustainability outcomes. The finding is consistent with Guthridge et al. (2022) who asserted that gender-responsive educational practices promote equitable access and improve institutional effectiveness. Similarly, Rosa and Clavero (2022) emphasized that eliminating gender disparities strengthens participation and academic performance, thereby supporting long-term school development. The significance of the relationship further confirms that gender equality is not only a social goal but also a strategic factor in achieving sustainable educational systems.

The study also found a strong positive correlation between inclusive education and the sustainable development of public secondary schools ($r = 0.72$). This indicates that accommodating diverse learners and ensuring equitable access to education contribute meaningfully to school sustainability. This finding aligns with Mbua (2023), who noted that inclusive education enhances participation and improves learning outcomes for all categories of students. In addition, Ugochukwu (2023) maintained that inclusive practices foster adaptability and resilience in school systems, which are critical for sustainability. The significant relationship observed in this study underscores the importance of integrating inclusive policies into school administration and instructional delivery.

Furthermore, the study revealed a strong joint correlation between gender equality, inclusive education and sustainable development ($R = 0.79$, $R^2 = 0.62$). This suggests that both variables collectively explain a substantial proportion of variations in the sustainable development of public secondary schools. The finding corroborates Ibeagha and Nwachukwu (2025), who argued that combining equity and inclusiveness strengthens institutional capacity and improves educational outcomes. Similarly, Alumona and Odoh (2025) emphasized that gender-sensitive and inclusive policies jointly create enabling learning environments that enhance long-term school

effectiveness. The significance of the joint relationship indicates that sustainable school development is better achieved through integrated and complementary approaches rather than isolated interventions.

Conclusion

The study concluded that gender equality and inclusive education are significant correlates of the sustainable development of public secondary schools in Awka Education Zone, Anambra State. The findings demonstrated that both variables individually and jointly contribute to improving educational outcomes, enhancing participation and promoting long-term institutional effectiveness. Gender equality ensures balanced opportunities for all learners, while inclusive education accommodates diverse learning needs, thereby fostering equitable and quality education. The combined influence of these variables further strengthens the capacity of schools to achieve sustainable development goals. Therefore, integrating gender-responsive and inclusive practices into school management is essential for improving the overall performance and sustainability of public secondary schools.

Recommendations

1. School administrators should implement gender-sensitive policies that promote equal participation and opportunities for both male and female students in all school activities.
2. Government and educational stakeholders should provide adequate resources and training to support the effective implementation of inclusive education practices in public secondary schools.
3. Principals should adopt integrated strategies that combine gender equality and inclusive education to enhance the sustainable development and overall effectiveness of secondary schools.

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DEMYSTIFYING SUPERSTITIOUS CULTURAL BELIEFS THROUGH COMPUTATIONAL MODELLING ACTIVITIES AND GAMIFICATION AMONG SECONDARY SCHOOL PHYSICS STUDENTS

Veronica Folasade T. Babajide, Ph.D[1]; Celestine Ogah[2] & Niyi Ashogbon[3]
Department of Science Education, University of Lagos
vbabajide@unilag.edu.ng[1] | meetniyi@gmail.com[2] | ogahcelestine71@gmail.com[3]

Abstract
This study investigated secondary school students' awareness of superstitious cultural beliefs conflicting with physics learning, their opinions on computational modelling and gamification as pedagogical tools, and the perceived effectiveness of these technologies in demystifying such beliefs. The study adopted a mixed methods design, integrating both quantitative and qualitative approaches through the use of a structured questionnaire and interview sessions. The accessible population comprised 1,200 Senior Secondary School Two (SS2) students drawn from private secondary schools in Magboro, Ogun State, and Lagos Island, Lagos State, Nigeria. Applying the Taro Yamane (1967) formula at a 5% margin of error, a sample of 300 students was derived. A multi-stage sampling procedure was employed for participant selection, while ten students were purposively selected for interview sessions to obtain deeper qualitative insights. A 4-point Likert-type questionnaire validated for content and reliability (Cronbach's $\alpha = 0.87$) served as the primary quantitative instrument. Data were analysed using descriptive statistics and independent-samples t-tests for the quantitative strand, while interview responses were subjected to thematic analysis. Findings revealed that students demonstrated a high level of awareness of superstitious cultural beliefs in conflict with physics learning (Grand Mean = 2.90), expressed strongly positive opinions about the use of computational modelling and gamification in physics education (Grand Mean = 3.15), and firmly believed in the effectiveness of these technologies in demystifying superstitious beliefs (Grand Mean = 3.31). Challenges to implementation were rated below the disagreement threshold (Grand Mean = 2.15). The independent-samples t-test found no statistically significant gender differences across any of the three main constructs ($p > 0.05$). Qualitative themes further confirmed that technology-based learning enhances understanding, reduces superstitious beliefs, and promotes evidence-based reasoning. The study recommends curriculum reform, teacher training, and digital infrastructure investment.

Keywords: Demystifying, superstitious and cultural beliefs, gamification and computational modelling, physics learning

Introduction

Science education occupies a foundational position in any nation's ambition for technological development and economic self-sufficiency. Among the natural sciences taught at the secondary school level, physics stands out for its role in explaining the fundamental laws governing the universe. Yet despite its explanatory power and practical relevance, physics consistently ranks among the least popular and most poorly understood subjects in Nigerian secondary schools (Abimbola & Abubakar, 2019). A significant contributor to this challenge is the persistence of superstitious and culturally embedded beliefs that conflict with scientific reasoning. When students arrive in the classroom carrying cultural narratives that attribute thunder to the anger of deities or eclipses to cosmic misfortune, the cognitive distance between their worldview and the scientific concepts they must master becomes formidable.

The challenge of cultural interference in science learning is not unique to Nigeria; it is observed across sub-Saharan Africa, Southeast Asia, and indigenous communities globally, wherever traditional epistemologies encounter formal science instruction (Cobern, 1994; Ogawa, 1995). In the Nigerian context, examples include beliefs that thunder and lightning are expressions of spiritual anger, eclipses signify supernatural warnings, rainfall results primarily from ritual practices, or unusual physical events are caused by mystical forces rather than natural laws. Such interpretations may discourage questioning, experimentation, and scientific explanation in the classroom. What distinguishes the Nigerian context is the depth and social authority of its cultural belief systems, sustained not only by informal community transmission but in some cases reinforced within school environments where teachers themselves navigate the tension between cultural identity and scientific obligation.

Computational modelling and gamification represent two innovative pedagogical responses to this challenge. Computational modelling - the use of digital simulations, virtual experiments, and interactive models to represent physical phenomena - has demonstrated consistent effectiveness in improving conceptual understanding in physics (Wieman & Perkins, 2005; Smetana & Bell, 2012). Gamification — the incorporation of game design principles such as challenges, rewards, progression, and narrative into instructional contexts - has been shown to enhance learner motivation, promote deeper cognitive engagement, and foster evidence-based thinking (Deterding et al., 2011; Hamari et al., 2014). Together, these approaches offer a pedagogical framework that is simultaneously engaging, experiential, and scientifically rigorous.

This study was designed to address the gap in empirical evidence by investigating the perceptions of secondary school physics students regarding the potential of these technologies to demystify superstitious cultural beliefs. Specifically, the study examined students' level of awareness of culturally conflicting beliefs, their opinions on technology-enhanced physics instruction, the perceived effectiveness of computational modelling and gamification as epistemic correctives, and the challenges hindering their implementation.

Statement of the Problem

The persistence of superstitious cultural beliefs among secondary school physics students in Nigeria represents a significant and largely unaddressed impediment to science learning. While curriculum documents articulate scientific explanations for a wide range of natural phenomena, many students continue to hold culturally derived alternative explanations that compete with and resist scientific accounts. Conventional teaching methods - primarily lecture and demonstration - are ill-suited to challenging deeply rooted epistemological commitments. The opinion of students on the potential of computational modelling and gamification to address this problem has been theoretically proposed but remains empirically underexplored in the Nigerian secondary school context.

Objectives of the Study

The broad objective of this study was to examine the perceptions of secondary school physics students regarding computational modelling and gamification as instructional approaches in relation to superstitious cultural beliefs and physics learning. Specifically, the study sought to: (1) determine students' level of awareness of superstitious cultural beliefs conflicting with physics learning; (2) assess students' opinions on computational modelling and gamification in physics education; (3) evaluate students' perceptions of the potential effectiveness of these technologies in promoting scientific understanding and reducing dependence on superstitious explanations; (4) examine gender differences across all three constructs; and (5) identify challenges hindering the implementation of computational modelling in secondary school physics.

Research Questions

The study was guided by the following research questions: **(1)** What is the level of students' awareness of superstitious cultural beliefs in conflict with the learning of physics in secondary schools? **(2)** What is the level of students' opinions on computational modelling and gamification in effective learning of physics in secondary schools? **(3)** What is the opinion of physics students on the effectiveness of computational modelling and gamification in demystifying superstitious beliefs in secondary school physics? **(4)** What is the difference in the opinion of male and female students on the awareness of superstitious cultural beliefs in conflict with the learning of physics? **(5)** What is the difference in the opinion of male and female students on computational modelling and gamification in demystifying superstitious beliefs in secondary school physics? **(6)** What is the difference in the opinion of male and female students on the effectiveness of computational modelling and gamification in demystifying superstitious beliefs in physics? **(7).** What challenges hinder the implementation of computational modelling in secondary school physics?

Scope of the Study

This study was delimited in terms of its geographic coverage, target population, subject matter, instructional variables, and research constructs. Geographically, the study covered selected private secondary schools located in Magboro, Ogun State and Eti-Osa, Lagos State. In terms of target population, only Senior Secondary School Two (SS2) physics students were included; students in other classes and public schools were excluded. Regarding subject matter, the study focused strictly on physics learning and not other science subjects. The instructional variables were limited to computational modelling and gamification, while the research constructs were restricted to students' awareness of superstitious cultural beliefs, opinions on technology-enhanced learning, perceived effectiveness, gender differences, and implementation challenges. Findings should therefore be interpreted within these delimitations.

Significance of the Study

This study is significant at theoretical, pedagogical, policy, sociocultural, and research levels within science education. Theoretically, it contributes to literature on the interaction between cultural beliefs and science learning in sub-Saharan Africa. By demonstrating students' awareness of superstitious belief conflicts and their acceptance of computational modelling and gamification, the study extends the conceptual change theory which explains how learners replace misconceptions with scientific understanding (Posner et al., 1982). It also supports the broader discussion on worldview conflict in science education (Cobern, 1994).

Pedagogically, the findings provide evidence that secondary school students are receptive to technology-enhanced learning approach. Computational modelling and gamification were perceived as useful for visualizing abstract concepts, promoting independent learning, enhancing critical thinking, and improving problem-solving skills. This supports the adoption of learner-centred and interactive instructional strategies in physics education.

At the curriculum and policy level, the study provides justification for integrating computational modelling and gamification into Nigerian secondary school physics education. The findings would guide curriculum agencies and education policymakers in strengthening digital learning initiatives and prioritizing teacher training, ICT infrastructure, and educational technology investments.

For school administrators and private school proprietors, the study highlights the importance of investing in digital infrastructure and continuous teacher professional development to support technology-integrated pedagogy and improve instructional delivery.

From sociocultural perceptive, the study demonstrates that scientific knowledge of physics can promote productive engagement between cultural identity and scientific knowledge rather than cultural rejection. It shows that computational modelling and gamification can help students apply scientific reasoning to familiar cultural experiences.

Finally, the study provides a validated framework and empirical foundation for future studies in science education, educational technology, and cultural studies, serving as a basic for experimental, longitudinal, and comparative investigations across contexts.

Conceptual clarification of terms

Computational Modelling: In this study, computational modelling refers to the application of digital activities and simulations to improve students' understanding of physics concepts and reduce misconceptions.

Gamification: Gamification refers to the integration of game-based instructional activities into physics teaching to promote active learning and scientific reasoning.

Superstitious Cultural Beliefs: Superstitious cultural beliefs refer to traditional or socially transmitted beliefs that attribute natural events and scientific phenomena to supernatural or mystical causes rather than scientific explanations.

Demystification: Demystification refers to the process of removing misconceptions, myths, or false beliefs through scientific explanations and evidence-based learning experiences.

Physics Learning: Physics learning refers to the process through which students acquire knowledge, skills, attitudes, and scientific understanding of physical concepts and natural phenomena.

Students' Opinion: Students' opinion refers to students' perceptions, views, judgments, and responses regarding learning experiences and instructional approaches. In this study, it refers to students' perceptions of computational modelling and gamification in improving physics learning and reducing superstitious beliefs.

Theoretical Framework

This study is anchored on three complementary theoretical perspectives: Constructivist Learning Theory (Piaget, 1952), Social Cognitive Theory (Bandura, 1986), and Conceptual Change Theory (Posner et al., 1982). Constructivism explains how students actively construct knowledge through interaction with digital environments, thereby enabling them to reconstruct culturally embedded beliefs through engagement with computational models. Social Cognitive Theory explains how technology-supported environments shape students' attitudes and beliefs through observation, interaction, and self-efficacy development. Conceptual Change Theory provides the epistemological mechanism through which superstitious beliefs can be replaced: students must encounter dissatisfaction with their existing beliefs, find the scientific alternative intelligible and plausible, and 172ecognize its greater explanatory power. Computational modelling and gamification create precisely these conditions by offering experiential, visual, and evidence-based encounters with physical phenomena.

Review of Related Literature

Superstitious Cultural Beliefs and Science Learning

The relationship between cultural belief systems and science education has attracted sustained scholarly attention. Cobern (1994) theorized that students do not arrive at school as blank epistemic slates but as culturally constituted beings whose worldviews shape how they receive and evaluate new information. When scientific content conflicts with supernatural explanations that a student's culture provides, the cultural framework frequently prevails because it is more deeply embedded in identity and social experience. In the Nigerian context, this collision is particularly pronounced in physics, where phenomena such as thunder, lightning, and eclipses carry rich histories of supernatural interpretation across Yoruba, Igbo, and Hausa traditions (Ogunniyi, 2007; Adetunji & Bamidele, 2021).

Several Nigerian studies have confirmed the prevalence of superstitious beliefs among secondary school science students and their negative correlation with conceptual understanding and academic achievement (Abimbola & Abubakar, 2019; Aina & Olanipekun, 2020). Examples include beliefs that eclipses are supernatural signs, thunder is caused by spiritual forces, lightning represents divine punishment, or unusual physical events occur through mystical influence rather than natural processes. The challenge for physics educators is not merely to correct false beliefs but to do so in a manner that respects cultural identity while cultivating scientific literacy - a process that requires pedagogical approaches grounded in experience and evidence (Duit & Treagust, 2003; Taber, 2013).

Computational Modelling in Physics Education

Computational modelling refers to the use of digital tools - including simulations, virtual laboratories, and interactive animations - to represent, explore, and manipulate scientific phenomena. Mayer's (2019) cognitive theory of multimedia learning provides robust theoretical justification, demonstrating that learning is substantially enhanced when verbal explanation is accompanied by visual and interactive representation. Empirical evidence for its effectiveness in physics education is extensive: Smetana and Bell (2012) concluded from a systematic review of forty-six studies that computer simulations consistently improve conceptual understanding and increase student engagement. Studies in sub-Saharan African contexts have broadly replicated these findings, noting particular benefits for students from resource-constrained backgrounds (Bello & Abimbola, 2014; Aina & Olanipekun, 2020).

Crucially, computational modelling has demonstrated effectiveness as a tool for conceptual change. When students can observe, in a simulated environment, the electromagnetic processes that generate lightning, the gravitational mechanics that produce eclipses, or the wave properties that account for thunder, they are presented with empirical evidence that is compelling and culturally non-threatening, creating cognitive space for gradual epistemic reorientation (Posner et al., 1982; Wieman & Perkins, 2005).

Gamification and Student Motivation

Gamification involves the application of game design elements - points, badges, leaderboards, challenges, and immediate feedback - to non-game educational contexts to promote engagement and learning (Deterding et al., 2011). It is theoretically grounded in self-determination theory (Ryan & Deci, 2000), which identifies autonomy, competence, and relatedness as the fundamental psychological needs whose satisfaction drives intrinsic motivation. Hamari et al. (2014), in a systematic review of twenty-four studies, found that gamification produced positive effects on student engagement and learning outcomes in the majority of cases. In the context of demystifying

superstitious beliefs, gamified narrative structures can create scenarios requiring students to apply scientific reasoning to culturally familiar situations, making the cognitive encounter with scientific explanation both contextually meaningful and personally relevant (Prensky, 2007; Dichev & Dicheva, 2017).

Methodology

This study adopted a mixed methods research design, integrating both quantitative and qualitative approaches. The quantitative strand employed a descriptive survey design using a structured 4-point Likert-scale questionnaire, while the qualitative strand utilised semi-structured interview sessions with purposively selected participants. The mixed methods approach was appropriate because it enabled triangulation of findings, combining the breadth afforded by large-sample survey data with the depth provided by qualitative interview responses (Creswell & Creswell, 2018; Johnson & Onwuegbuzie, 2014). This design allowed for a comprehensive understanding of students' perceptions that neither approach alone could have achieved.

The study was conducted in two local government areas across two Nigerian states: Magboro in the Obafemi Owode Local Government Area of Ogun State, and Eti-Osa in the Lagos Island Local Government Area of Lagos State. These locations were selected to capture student perspectives from proximate but contextually distinct communities — one peri-urban and the other densely urban — thereby enriching the representativeness of findings within the Lagos–Ogun corridor of southwestern Nigeria.

The accessible population for this study comprised 1,200 Senior Secondary School Two (SS2) physics students enrolled in private secondary schools within Lagos Island LGA, Lagos State, and Obafemi Owode LGA, Ogun State. SS2 students were specifically targeted because they have completed sufficient secondary-level physics instruction to engage meaningfully with study constructs, while remaining within the formative period of secondary education where pedagogical interventions are most impactful.

A multi-stage sampling procedure was employed. In the first stage, purposive sampling was used to select two LGAs - one from each state - providing adequate access to SS2 students in private secondary schools. In the second stage, simple random sampling using balloting was applied to select one private secondary school from each LGA, yielding two participating schools. In the third stage, the Taro Yamane (1967) formula was applied to determine an adequate sample size from the accessible population of 1,200 students.

The Taro Yamane formula is expressed as: $\boldsymbol{n = \frac{N}{1 + Ne^2}}$

Where: **n** = required sample size, N = accessible population = 1,200, **e** = margin of error = 0.05 (5%)

Substituting the values:

$$n = \frac{1{,}200}{1 + 1{,}200 \times (0.05)^2} \rightarrow n = \frac{1{,}200}{(1 + 1{,}200 \times 0.0025)} \rightarrow n = \frac{1{,}200}{1 + 3.00}$$

$$n = \frac{1{,}200}{4.00} \quad \therefore \boldsymbol{n = 300}$$

Accordingly, a sample of 300 students was selected, comprising 157 males (52.33%) and 143 females (47.67%) across the two participating schools.

Two instruments were used for data collection. The primary quantitative instrument was a structured questionnaire titled "Questionnaire on Gamification and Computational Modelling Activities for Demystifying Superstitious Cultural Beliefs in Physics." It comprised forty 4-point Likert-scale items (SA = 4, A = 3, D = 2, SD = 1) organised into four thematic sections: awareness of superstitious beliefs (Section B, 10 items); opinions on computational modelling and gamification (Section C, 10 items); perceived effectiveness of technology-based learning in demystifying superstitious beliefs (Section D, 10 items); and implementation challenges (Section E, 10 items). The qualitative instrument consisted of five semi-structured interview questions designed to elicit in-depth narrative responses on students' lived experiences with technology-based physics learning and its influence on their cultural beliefs.

Content validity was established through expert review by three specialists - two in science education and one in educational measurement - whose feedback was incorporated into the revised instrument. A pilot administration with thirty students from a school outside the main study sample yielded a Cronbach's alpha reliability coefficient of $\alpha = 0.87$, which exceeds the accepted threshold of 0.70 (Nunnally & Bernstein, 2010), confirming adequate internal consistency.

Quantitative data were analysed using descriptive statistics (frequency counts, percentages, means, and standard deviations) for Research Questions 1-3 and 7, and independent-samples t-tests for Research Questions 4–6 examining gender differences (significance level: $p < 0.05$). A mean cut-off of 2.50 was adopted as the decision criterion. Qualitative interview data were subjected to thematic analysis following the six-phase framework of Braun and Clarke (2012), with themes emerging inductively from repeated reading and coding of participant responses.

Results

The presentation of the analysis is organized into three main sections: the demographic analysis of respondents, the answering of research questions using descriptive statistics, and the testing of hypotheses using inferential statistics.

Demographic Characteristics of Respondents

The gender distribution of the students was computed to determine the representation of male and female participants in the study.

Table 1: Demographic Analysis

Gender	***Frequency (N)***	***Percentage (%)***
Female	*143*	*47.67*
Male	*157*	*52.33*
Grand Total	***300***	***100.00***

Interpretation: The table above indicates that out of the 300 sampled respondents, 143 are female, representing 47.67%, while 157 are male, representing 52.33%. This demonstrates a relatively balanced gender representation within the sampled population.

Answering Research Questions

The responses collected through the four-point Likert scale (coded as SA = 4, A = 3, D = 2, SD = 1) were analyzed using mean scores and standard deviations. A mean score of 2.50 was adopted as the baseline decision criterion (cut-off score) for acceptance or rejection.

Research Question 1: Students' Awareness of Superstitious Cultural Beliefs Conflicting with Physics Learning

Table 2: Frequency Distribution, Means, and Standard Deviations for Students' Awareness of Superstitious Cultural Beliefs Conflicting with Physics Learning (N = 300)

Item	SA f (%)	A f (%)	D f (%)	SD f (%)	Mean	SD	Decision
B1. Some people believe certain natural phenomena are caused by supernatural powers.	90 (30.0%)	115 (38.3%)	63 (21.0%)	32 (10.7%)	2.88	0.96	Agree
B2. I have heard cultural explanations for thunder, eclipse, or lightning.	92 (30.7%)	115 (38.3%)	61 (20.3%)	32 (10.7%)	2.89	0.96	Agree
B3. Superstitious beliefs can influence students' understanding of physics.	82 (27.3%)	126 (42.0%)	67 (22.3%)	25 (8.3%)	2.88	0.91	Agree
B4. Some students believe physics phenomena are mysterious rather than scientific.	98 (32.7%)	110 (36.7%)	62 (20.7%)	30 (10.0%)	2.92	0.96	Agree
B5. I can differentiate between scientific explanations and superstitious beliefs.	87 (29.0%)	129 (43.0%)	57 (19.0%)	27 (9.0%)	2.92	0.91	Agree
B6. Cultural beliefs sometimes affect students' interest in learning physics.	81 (27.0%)	128 (42.7%)	62 (20.7%)	29 (9.7%)	2.87	0.92	Agree
B7. I believe superstitious explanations are more reliable than scientific reasoning.	96 (32.0%)	120 (40.0%)	55 (18.3%)	29 (9.7%)	2.94	0.94	Agree
B8. Some traditional beliefs discourage students from asking scientific questions.	97 (32.3%)	121 (40.3%)	57 (19.0%)	25 (8.3%)	2.97	0.92	Agree
B9. Superstitious beliefs make it difficult for some students to understand science.	86 (28.7%)	122 (40.7%)	56 (18.7%)	36 (12.0%)	2.86	0.97	Agree
B10. Physics helps students understand events often misunderstood culturally.	97 (32.3%)	104 (34.7%)	66 (22.0%)	33 (11.0%)	2.88	0.99	Agree

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree; f = frequency; % = percentage. Decision rule: Mean ≥ 2.50 = Agreed; Mean < 2.50 = Disagreed**.**
Grand Mean = 2.90; Grand SD = 0.94.

Table 2 shows that all ten items measuring students' awareness of superstitious cultural beliefs conflicting with physics learning recorded mean scores above the decision threshold of 2.50, indicating agreement across the entire section.

Research Question 2: Students' Opinions on Computational Modelling and Gamification in Physics Learning

Table 3: Frequency Distribution, Means, and Standard Deviations for Students' Opinions on Computational Modelling and Gamification in Physics Learning (N = 300)

Item	SA f (%)	A f (%)	D f (%)	SD f (%)	Mean	SD	Decision
C1. Computational modelling makes physics lessons more interesting.	112 (37.3%)	127 (42.3%)	45 (15.0%)	16 (5.3%)	3.12	0.85	Agree
C2. I understand physics better when simulations and digital models are used.	115 (38.3%)	129 (43.0%)	42 (14.0%)	14 (4.7%)	3.15	0.83	Agree
C3. Technology-based learning improves my participation during physics lessons.	118 (39.3%)	115 (38.3%)	48 (16.0%)	19 (6.3%)	3.11	0.89	Agree
C4. I enjoy solving physics problems using computer-based activities.	131 (43.7%)	109 (36.3%)	49 (16.3%)	11 (3.7%)	3.20	0.84	Agree
C5. Simulations and animations make abstract physics concepts easier to understand.	111 (37.0%)	130 (43.3%)	47 (15.7%)	12 (4.0%)	3.13	0.82	Agree
C6. Technology-based learning encourages critical thinking in physics.	121 (40.3%)	120 (40.0%)	42 (14.0%)	17 (5.7%)	3.15	0.87	Agree
C7. Technology-supported learning increases my motivation to learn physics.	125 (41.7%)	113 (37.7%)	51 (17.0%)	11 (3.7%)	3.17	0.84	Agree
C8. Gamification helps students learn independently.	124 (41.3%)	118 (39.3%)	46 (15.3%)	12 (4.0%)	3.18	0.83	Agree
C9. I prefer technology-based learning to the traditional chalk-and-talk method.	118 (39.3%)	123 (41.0%)	43 (14.3%)	16 (5.3%)	3.14	0.86	Agree
C10. I learn physics better without technology-based activities. (Reverse-scored)	113 (37.7%)	129 (43.0%)	47 (15.7%)	11 (3.7%)	3.15	0.81	Agree

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree; f = frequency; % = percentage. Decision rule: Mean ≥ 2.50 = Agreed.
Grand Mean = 3.15; Grand SD = 0.84.

Table 3 demonstrates that students expressed uniformly positive opinions about computational modelling and gamification in physics education, with all ten items exceeding the 2.50 threshold.

Research Question 3: Effectiveness of Computational Modelling and Gamification in Demystifying Superstitious Beliefs

Table 4: Frequency Distribution, Means, and Standard Deviations for Students' Opinions on the Effectiveness of Computational Modelling and Gamification in Demystifying Superstitious Beliefs (N = 300)

Item	SA f (%)	A f (%)	D f (%)	SD f (%)	Mean	SD	Decision
D1. Technology-based learning helps students rely more on scientific explanations.	152 (50.7%)	102 (34.0%)	31 (10.3%)	15 (5.0%)	3.30	0.85	Agree
D2. Simulations help students understand scientific causes of natural events.	156 (52.0%)	94 (31.3%)	33 (11.0%)	17 (5.7%)	3.30	0.88	Agree
D3. Technology-based learning can reduce superstitious beliefs related to science.	166 (55.3%)	101 (33.7%)	22 (7.3%)	11 (3.7%)	3.41	0.78	Agree
D4. Computational activities help students challenge myths and misconceptions in physics.	149 (49.7%)	109 (36.3%)	26 (8.7%)	16 (5.3%)	3.30	0.84	Agree
D5. Scientific animations help students understand events linked with superstition.	147 (49.0%)	108 (36.0%)	30 (10.0%)	15 (5.0%)	3.29	0.84	Agree
D6. Gamification promotes logical and evidence-based thinking.	141 (47.0%)	112 (37.3%)	27 (9.0%)	20 (6.7%)	3.25	0.88	Agree
D7. Students become more scientifically minded with technology-based learning.	168 (56.0%)	92 (30.7%)	32 (10.7%)	8 (2.7%)	3.40	0.78	Agree
D8. Digital learning activities help students question unscientific cultural beliefs.	152 (50.7%)	103 (34.3%)	33 (11.0%)	12 (4.0%)	3.32	0.82	Agree
D9. Technology-based learning bridges the gap between culture and science.	139 (46.3%)	110 (36.7%)	32 (10.7%)	19 (6.3%)	3.23	0.88	Agree
D10. Technology-based learning does not help students overcome superstitious beliefs. (R)	148 (49.3%)	110 (36.7%)	30 (10.0%)	12 (4.0%)	3.31	0.81	Agree

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree; f = frequency; % = percentage. Decision rule: Mean ≥ 2.50 = Agreed.
Grand Mean = 3.31; Grand SD = 0.84.

Table 4 presents the highest grand mean recorded in this study (3.31, SD = 0.84), indicating that students hold particularly strong convictions about the effectiveness of computational modelling and gamification in demystifying superstitious beliefs. All ten items were agreed upon, with means ranging from 3.23 (item D9) to 3.41 (item D3).

Research Question 4: Challenges to the Implementation of Computational Modelling in Secondary School Physics

Table 5: Frequency Distribution, Means, and Standard Deviations for Challenges Hindering the Implementation of Computational Modelling in Secondary School Physics (N = 300)

Item	SA f (%)	A f (%)	D f (%)	SD f (%)	Mean	SD	Decision
E1. Lack of computers affects the use of computational modelling in schools.	32 (10.7%)	71 (23.7%)	110 (36.7%)	87 (29.0%)	2.16	0.96	Disagree
E2. Poor electricity supply limits technology-based learning in physics.	28 (9.3%)	77 (25.7%)	102 (34.0%)	93 (31.0%)	2.13	0.96	Disagree
E3. Many schools do not have adequate digital learning facilities.	19 (6.3%)	71 (23.7%)	113 (37.7%)	97 (32.3%)	2.04	0.90	Disagree
E4. Some teachers are not well trained in technology-based learning.	29 (9.7%)	94 (31.3%)	92 (30.7%)	85 (28.3%)	2.22	0.97	Disagree
E5. Internet access is a challenge in using technology-based learning.	27 (9.0%)	68 (22.7%)	114 (38.0%)	91 (30.3%)	2.10	0.94	Disagree
E6. Scientific simulations are unnecessary in physics lessons.	39 (13.0%)	74 (24.7%)	99 (33.0%)	88 (29.3%)	2.21	1.01	Disagree
E7. Time allocated for physics is not enough for technology-based learning.	23 (7.7%)	83 (27.7%)	92 (30.7%)	102 (34.0%)	2.09	0.96	Disagree
E8. Some students prefer traditional teaching to technology-based learning.	20 (6.7%)	75 (25.0%)	125 (41.7%)	80 (26.7%)	2.12	0.88	Disagree
E9. The cost of digital devices makes gamification and computational learning difficult.	27 (9.0%)	81 (27.0%)	108 (36.0%)	84 (28.0%)	2.17	0.94	Disagree
E10. Lack of technical support discourages technology-based learning in schools.	34 (11.3%)	75 (25.0%)	112 (37.3%)	79 (26.3%)	2.21	0.96	Disagree

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree; f = frequency; % = percentage. Decision rule: Mean ≥ 2.50 = Agreed; Mean < 2.50 = Disagreed.
Grand Mean = 2.15; Grand SD = 0.95.

Table 5 shows that respondents generally disagreed that the listed challenges significantly discourage learning by computational modelling in schools, as reflected by the grand mean of 2.15 (SD = 0.95), which is below the decision benchmark of 2.50.

Research Questions 4–6: Gender Differences Across the Three Main Constructs

Table 6: Independent-Samples t-Test Results for Gender Differences on Awareness, Opinions on Technology, and Perceived Effectiveness of Computational Modelling and Gamification (Male n = 157; Female n = 143)

RQ	Male Mean	Male SD	Female Mean	Female SD	t-value	p-value	Decision
RQ4 (Awareness)	2.917	0.316	2.884	0.317	0.910	0.364	Not Significant
RQ5 (CM & Gamification)	3.155	0.259	3.144	0.254	0.383	0.702	Not Significant
RQ6 (Effectiveness)	3.293	0.267	3.330	0.260	-1.218	0.224	Not Significant

Note. CM = Computational Modelling; df = degrees of freedom; p-values based on two-tailed test. *Significance level: $p < 0.05$.

Table 6 presents the results of the independent-samples t-tests conducted to examine gender differences across the three main constructs. For Research Question 4 (Awareness), male students recorded a mean of 2.917 (SD = 0.316) and female students a mean of 2.884 (SD = 0.317). The t-test yielded $t = 0.910$, $p = 0.364$, indicating no statistically significant difference ($p > 0.05$). For Research Question 5 (Opinions on Computational Modelling and Gamification), the male mean was 3.155 (SD = 0.259) and the female mean was 3.144 (SD = 0.254), with $t = 0.383$, $p = 0.702$ - again, not significant. For Research Question 6 (Perceived Effectiveness), female students (M = 3.330, SD = 0.260) recorded a marginally higher mean than male students (M = 3.293, SD = 0.267), but the difference was not statistically significant ($t = -1.218$, $p = 0.224$). The null hypothesis of no significant gender difference was therefore not rejected for any of the three research questions.

Interview Responses (10 Students)

Q1. How does technology-based learning help you understand physics concepts better?

Participants	Responses
P1	Simulations help me see how physics works instead of only imagining it.
P2	Computer activities make difficult topics easier to understand.
P3	Animations show scientific explanations clearly.
P4	I learn faster when I interact with digital models.
P5	Technology makes physics more practical and interesting.
P6	Games and simulations improve my understanding.
P7	Visual learning helps me remember concepts.
P8	It allows me to practise and correct mistakes.
P9	I understand calculations better using digital tools.
P10	Technology makes abstract ideas easier to explain.

Q2. Can technology-based learning reduce superstitious beliefs in science?

Participants	Responses
P1	Yes, because science explanations become clearer.
P2	Simulations show evidence instead of myths.
P3	It encourages students to ask questions.
P4	Technology helps students think scientifically.
P5	Students depend less on cultural assumptions.

P6	It reduces misconceptions through demonstrations.
P7	It helps students trust scientific evidence.
P8	Learning with technology challenges false beliefs.
P9	Students become more logical.
P10	It promotes understanding rather than superstition.

Q3. What challenges do you face when using computational activities?

Participants	Responses
P1	Limited access to computers.
P2	Electricity interruptions affect learning.
P3	Slow internet connection.
P4	Insufficient digital facilities.
P5	Lack of technical support.
P6	Some activities are difficult initially.
P7	Not enough class time.
P8	Some students are unfamiliar with technology.
P9	Devices are expensive.
P10	Teachers sometimes need more training.

Q4. Suggest ways schools can improve technology-based learning.

Participants	Responses
P1	Provide more computers.
P2	Improve electricity supply.
P3	Train teachers regularly.
P4	Create digital laboratories.
P5	Introduce more educational software.
P6	Improve internet facilities.
P7	Increase practical lesson periods.
P8	Encourage student participation.
P9	Maintain available equipment.
P10	Support schools with funding.

Q5. Mention any superstitious belief you once had and how science clarified it.

Participants	Responses
P1	I thought thunder was caused by spirits; science explained electricity.
P2	I believed eclipses were supernatural; science explained planetary movement.
P3	I feared lightning myths until physics explained charges.
P4	I thought stars controlled events; science changed my view.
P5	I believed strange sounds had spiritual causes; science explained waves.
P6	I thought rain rituals caused rainfall; science explained weather.
P7	I linked illness to myths; science explained natural causes.
P8	I feared eclipses; science clarified them.
P9	I believed comets predicted events; science corrected this.
P10	I thought physics events were mysterious; science made them understandable.

Analysis of Interview Responses

This section presents the analysis of responses obtained from ten (10) purposively selected students who participated in the interview session. The interview was conducted to obtain deeper understanding of students' perceptions regarding the effectiveness of technology-based learning

(computational modelling and gamification) in demystifying superstitious cultural beliefs in learning physics. Responses were analysed using thematic analysis and presented according to emerging themes.

Theme 1: Technology-Based Learning (Computational Modelling and Gamification) Enhances Understanding of Physics Concepts
Most participants indicated that technology-based learning improved their understanding of physics concepts by making abstract ideas more practical and easier to visualise.
Examples of responses:
P1: Simulations help me see how physics works instead of only imagining it.
P4: I learn faster when I interact with digital models.
P10: Technology makes abstract ideas easier to explain.
Interpretation: The responses suggest that technology-supported instruction promotes meaningful learning and conceptual understanding among students.

Theme 2: Technology-Based Learning (Computational Modelling and Gamification) Reduces Superstitious Beliefs.
Students reported that exposure to simulations and scientific explanations reduced misconceptions and encouraged scientific reasoning.
Examples:
P2: Simulations show evidence instead of myths.
P7: It helps students trust scientific evidence.
Interpretation: Students perceived technology-based learning as an effective strategy for reducing superstitious cultural beliefs.

Theme 3: Challenges Affecting Technology-Based Learning (Computational Modelling and Gamification)
Participants identified several challenges including inadequate digital facilities, poor electricity supply, and limited access to devices.
Examples:
P1: Limited access to computers.
P2: Electricity interruptions affect learning.
Interpretation: Infrastructure limitations remain barriers to effective implementation.

Theme 4: Strategies for Improvement
Students suggested improved funding, teacher training, and provision of digital resources.
Interpretation: The responses indicate the need for institutional support for sustainable integration.

Theme 5: Science Clarifies Superstitious Beliefs
Participants reported that scientific explanations changed their previous cultural assumptions about natural phenomena.
Examples:
P1: I thought thunder was caused by spirits; science explained electricity.
Interpretation: Interview responses demonstrate that scientific instruction can help students replace misconceptions with evidence-based understanding.

Discussion of Findings
The finding that students demonstrated a high level of awareness of superstitious cultural beliefs conflicting with physics learning (Grand Mean = 2.90) is both significant and encouraging. It

indicates that cultural interference in science education is not subconscious but actively perceived by students themselves, consistent with Cobern (1994) and Ogunniyi (2007). The particular prominence of the item concerning suppression of scientific questioning by traditional beliefs resonates with long-standing concerns in the African science education literature (Abimbola & Abubakar, 2019; Adetunji & Bamidele, 2021).

The strongly positive student opinions on computational modelling and gamification (Grand Mean = 3.15) reflect a learner population that is both receptive to and desirous of technology-enhanced instruction. This finding aligns with the empirical literature on the motivational and cognitive benefits of digital learning tools in STEM education (Mayer, 2019; Smetana & Bell, 2012; Hamari et al., 2014). The high agreement with items relating to computer-based problem-solving, independent learning through gamification, and computational modelling as a motivational scaffold is consistent with self-determination theory's emphasis on autonomy and competence as drivers of intrinsic motivation (Ryan & Deci, 2000).

The highest grand mean in the study (3.31) was recorded for perceived effectiveness in demystifying superstitious beliefs. Students' strong endorsement reflects an intuitive grasp of the epistemological mechanism through which these technologies operate: by presenting empirical, visual, and interactive evidence for the scientific causes of natural phenomena, computational tools displace the ambiguity on which supernatural explanations depend. This is the experiential conditions-for-conceptual-change argument made by Posner et al. (1982) and elaborated by Duit and Treagust (2003). The qualitative interview themes convergently reinforced these quantitative findings, with multiple participants narrating actual instances of belief change prompted by scientific instruction.

The disagreement with challenge items (Grand Mean = 2.15), while superficially reassuring, requires cautious interpretation. The sampled students attend private schools with some baseline technology provision and may not have experienced the full severity of barriers present in public or rural schools. The digital divide literature (van Dijk, 2020) and UNESCO (2023) documentation of technology access inequities in sub-Saharan Africa suggest that these barriers remain significant at the system level and warrant sustained policy attention.

The absence of statistically significant gender differences across all three constructs (all $p > 0.05$) is consistent with the emerging consensus that gender gaps in ICT-related attitudes are narrowing as technology becomes more culturally normalised (Vekiri & Chronaki, 2008; OECD, 2021). The slight, non-significant female advantage on the effectiveness construct may warrant further investigation in future studies.

Qualitative Findings: Interview Analysis

Ten students purposively selected from the main sample participated in semi-structured interview sessions. Responses were subjected to thematic analysis (Braun & Clarke, 2012), yielding five major themes.

Overall, the qualitative findings confirmed and enriched all quantitative results, demonstrating convergent validity across the two strands of the mixed methods design.

Conclusion

This study has shown that physics students are aware of superstitious and cultural belief conflicting with the learning of physics at the secondary school level. Hence, they have positive coherent perceptions on computational modelling and gamification as tools for demystifying the

superstitious cultural beliefs in learning physics. The absence of significant gender differences obtained in the study reinforces the inclusive promise of these pedagogical innovations.

Recommendations

Based on the findings, the following recommendations are advanced: **(1)** Physics teachers should receive regular professional development training in the design and deployment of computational modelling and gamification tools for effective classroom integration. **(2)** The Nigerian Educational Research and Development Council (NERDC) should explicitly incorporate computational modelling and gamified learning frameworks into the secondary school physics curriculum as core instructional approaches. **(3)** State and federal authorities should prioritise investment in digital infrastructure — electricity supply, internet connectivity, and ICT device provision — to create enabling conditions for equitable technology-enhanced instruction across private and public school contexts. **(4)** School administrators should designate dedicated digital laboratory spaces for physics instruction. **(5)** Future research should employ experimental or quasi-experimental designs to establish causal relationships between these interventions and measurable changes in students' superstitious beliefs and physics achievement. **(6)** Curriculum developers should create culturally responsive gamified content drawing on familiar Nigerian cultural narratives to maximise relevance and impact.

Contribution to Knowledge

1. The study has revealed the opinion of secondary school physics students on the efficacy of computational modelling and gamification in demystifying superstitious and cultural beliefs in physics.
2. The study has established the power of inclusiveness in the students' opinion.

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RELATIONSHIP BETWEEN PRINCIPALS' CONFLICT MANAGEMENT STRATEGIES AND TEACHERS' COMPLIANCE WITH DIRECTIVES: IMPLICATIONS FOR MENTORSHIP AND SUSTAINABLE DEVELOPMENT.

Juliana Nkechi Odoh (Ph.D)
Department of Educational Management and Policy, Faculty of Education, Nnamdi Azikiwe University, Anambra State, Nigeria
nj.odoh@unizik.edu.ng, jullyodoh@gmail.com

Dr. Mariagoretti Ijeoma Obiakor
Department of Educational Management and Policy, Faculty of Education Nnamdi Azikiwe University, Awka Anambra State Nigeria.
mi.obiakor@unizik.edu.ng

Abstract
The study investigated the relationship between principals' conflict management strategies and teachers' compliance with directives and its implications for mentorship and sustainable development in public secondary schools in Anambra State, Nigeria. Two research questions and two null hypotheses guided the study. Correlational research design was adopted for the study. The population comprised 6,815 teachers in public secondary schools in Anambra State. A sample size of 2,727 teachers was selected using proportionate random sampling technique. Two researcher-developed instruments titled "Principals' Conflict Management Strategies Questionnaire (PCMSQ)" and "Teachers' Engagement in School Activities Questionnaire (TESAQ)" were used for data collection. The instruments were validated by three experts from the Faculty of Education, Nnamdi Azikiwe University, Awka. Cronbach Alpha reliability coefficients of 0.78 and 0.80 were obtained for PCMSQ and TESAQ respectively. Data collected were analyzed using Pearson Product Moment Correlation. Findings revealed that a significant relationship existed between non-confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State. The finding implied that teachers tend to comply more with directives when principals adopt accommodative and collaborative conflict management approaches that recognize teachers' interests and encourage harmonious working relationships. Based on the findings, it was recommended among others that the Ministry of Education should periodically organize seminars and workshops for principals on the continuous adoption of non-confrontational conflict management strategies to enhance teachers' compliance with directives, mentorship, and sustainable development in schools.

Keywords: Principals, Non-confrontational Conflict Management Strategy, Teachers, Compliance, Directives, Mentorship, Sustainable Development.

Introduction

Conflict is an inevitable phenomenon in every human organization, including educational institutions. In secondary schools, conflicts arise due to differences in values, interests, opinions, perceptions, goals, and expectations among principals, teachers, students, and other stakeholders. Effective management of such conflicts is essential for maintaining harmony, productivity, and organizational effectiveness. School principals, as administrative heads of schools, are expected to adopt appropriate conflict management strategies that promote cooperation and compliance among teachers.

Conflict management refers to the process through which administrators identify, address and resolve disagreements or misunderstandings in ways that reduce tension and improve organizational functioning. Principals employ different conflict management strategies such as confrontation, compromise, accommodation, avoidance, collaboration, and non-confrontational approaches. Among these strategies, non-confrontational conflict management strategy emphasizes dialogue, understanding, cooperation, tolerance, negotiation, and peaceful resolution of disputes without aggression or intimidation. Teachers' compliance with directives refers to the willingness of teachers to obey and implement official instructions, policies, and administrative decisions issued by school principals. Compliance is important for effective school administration, implementation of educational policies, maintenance of discipline, and achievement of educational goals. Teachers who comply with directives are more likely to contribute positively to school development and create conducive learning environments.

In many public secondary schools in Anambra State, there have been complaints of teachers' resistance to directives, poor participation in school activities, insubordination, and low commitment to administrative decisions. Such attitudes may be linked to the conflict management styles adopted by school principals. Principals who employ authoritarian or confrontational approaches may create hostility, fear, resentment, and reduced morale among teachers, thereby affecting their willingness to comply with directives. Conversely, principals who adopt non-confrontational and collaborative strategies may encourage mutual respect, trust, and positive working relationships.

Mentorship in schools involves guiding, supporting, and encouraging teachers to improve professionally and personally. Effective conflict management enhances mentorship by promoting communication, trust, cooperation, and teamwork among staff members. Sustainable development in education refers to continuous improvement in teaching, learning, administration, and institutional growth that can be maintained over time. Schools characterized by peaceful relationships and effective conflict management are more likely to experience sustainable development.

Therefore, this study investigated the relationship between principals' conflict management strategies and teachers' compliance with directives in public secondary schools in Anambra State and examined the implications for mentorship and sustainable development.

Statement of the Problem

Conflict among school personnel has become a recurring issue in many public secondary schools in Anambra State. Teachers often demonstrate negative attitudes such as refusal to comply with administrative directives, poor participation in school activities, absenteeism, resistance to change, and lack of cooperation with school management. These behaviours adversely affect school administration, mentorship programmes, academic performance, and sustainable development.

The situation may be attributed to the type of conflict management strategies adopted by principals. Principals who use harsh, authoritarian, and confrontational strategies may provoke resistance and reduce teachers' morale and commitment. On the other hand, principals who adopt non-confrontational strategies may foster harmonious relationships and encourage teachers' compliance with directives.

Despite the importance of conflict management in schools, there is limited empirical evidence on how principals' conflict management strategies relate to teachers' compliance with directives in public secondary schools in Anambra State. It is against this background that the study sought to

determine the relationship between principals' conflict management strategies and teachers' compliance with directives and its implications for mentorship and sustainable development.

Purpose of the Study

The main purpose of the study was to determine the relationship between principals' conflict management strategies and teachers' compliance with directives in public secondary schools in Anambra State. Specifically, the study sought to:

1. Determine the relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State.
2. Determine the relationship between confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State.

Research Questions

The following research questions guided the study:

1. What is the relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State?
2. What is the relationship between confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

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

Method

The study adopted correlational research design. The study was carried out in public secondary schools in Anambra State, Nigeria. The population of the study comprised 6,815 teachers in public secondary schools in the six education zones of Anambra State.

A sample size of 2,727 teachers was selected using proportionate random sampling technique to ensure fair representation of teachers across the education zones. Two instruments developed by the researcher were used for data collection. The first instrument titled "Principals' Conflict Management Strategies Questionnaire (PCMSQ)" sought information on principals' conflict management strategies, while the second instrument titled "Teachers' Engagement in School Activities Questionnaire (TESAQ)" measured teachers' compliance with principals' directives.

The instruments were subjected to face and content validation by three experts: one expert in Measurement and Evaluation from the Department of Educational Foundations and two experts from the Department of Educational Management and Policy, Faculty of Education, Nnamdi Azikiwe University, Awka.

The reliability of the instruments was established using Cronbach Alpha method. Reliability coefficients of 0.78 and 0.80 were obtained for PCMSQ and TESAQ respectively, indicating that the instruments were reliable for the study.

The researcher, with the assistance of five research assistants, administered the instruments to respondents across the six education zones. Data collected were analyzed using Pearson Product

Moment Correlation to answer the research questions and test the hypotheses at 0.05 level of significance.

Results

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

The analysis revealed a positive relationship between non-confrontational conflict management strategy and teachers' compliance with principals' directives. This indicates that when principals adopt accommodative, collaborative, and understanding approaches in resolving conflicts, teachers are more willing to comply with school directives and administrative decisions.

Research Question Two: What is the relationship between confrontational conflict management strategy and teachers' compliance with principals' directives in public secondary schools in Anambra State? The findings showed a weak negative relationship between confrontational conflict management strategy and teachers' compliance with principals' directives. This implies that the use of aggressive, forceful, and authoritarian conflict resolution approaches may discourage teachers from willingly complying with directives.

Test of Hypotheses

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

The hypothesis was rejected because the calculated probability value was less than the 0.05 level of significance. Therefore, there was a significant relationship between non confrontational conflict management strategy and teachers' compliance with principals' directives.

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

The hypothesis was rejected because the calculated probability value was less than the 0.05 level of significance. Therefore, there was a significant relationship between confrontational conflict management strategy and teachers' compliance with principals' directives.

Discussion of Findings

The study found that a significant positive relationship existed between non-confrontational conflict management strategy and teachers' compliance with principals' directives. This finding suggests that teachers are more likely to cooperate with school administration when principals employ peaceful, collaborative, and accommodative approaches to conflict resolution. Such approaches promote trust, mutual respect, teamwork, and positive interpersonal relationships among school personnel.

The finding aligns with human relations theory which emphasizes the importance of interpersonal relationships, communication, and staff welfare in organizational effectiveness. Principals who recognize teachers' feelings and involve them in decision-making processes create conducive environments that encourage compliance and commitment.

The study also revealed that confrontational conflict management strategy negatively affects teachers' compliance with directives. Principals who use intimidation, threats, and aggressive approaches may create resentment, fear, and dissatisfaction among teachers, thereby reducing their willingness to comply with administrative directives.

The findings have important implications for mentorship and sustainable development. Effective mentorship thrives in environments characterized by cooperation, trust, mutual understanding, and open communication. Non-confrontational conflict management strategy creates opportunities for principals to mentor teachers effectively, support professional growth, and enhance staff morale. Similarly, sustainable development in schools depends on peaceful coexistence, collaborative leadership, and positive organizational climate. Schools where conflicts are effectively managed are more likely to achieve continuous improvement in teaching, learning, and administration.

Implications for Mentorship and Sustainable Development

The findings of the study have several implications for mentorship and sustainable development in education.

1. Principals who adopt non-confrontational conflict management strategies create supportive environments that encourage effective mentorship among teachers.
2. Peaceful conflict resolution promotes trust, cooperation, and teamwork, which are necessary for sustainable school development.
3. Teachers who feel respected and valued are more likely to comply with directives, participate actively in school activities, and contribute to institutional growth.
4. Effective conflict management enhances teachers' morale, job satisfaction, and professional commitment.
5. Sustainable educational development can only be achieved in schools where harmonious relationships exist among staff members.

Conclusion

The study concluded that principals' conflict management strategies significantly relate to teachers' compliance with directives in public secondary schools in Anambra State. Specifically, non-confrontational conflict management strategy positively influences teachers' compliance with principals' directives, while confrontational strategy negatively affects compliance. Effective conflict management promotes mentorship, harmonious relationships, staff cooperation, and sustainable development in schools.

Recommendations

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

1. The Ministry of Education should periodically organize seminars and workshops for principals on effective non-confrontational conflict management strategies.
2. Principals should adopt collaborative and accommodative approaches in resolving conflicts to encourage teachers' compliance with directives.
3. School administrators should create opportunities for dialogue and participation in decision-making processes among teachers.
4. Principals should avoid excessive use of authoritarian and confrontational leadership styles that may discourage teachers' cooperation.
5. Mentorship programmes should be strengthened in schools to promote harmonious interpersonal relationships and sustainable development.

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TEACHERS' PROFESSIONAL IDENTITY, USE OF LEARNING MATERIALS, CONTENT KNOWLEDGE, ATTITUDE AND COMPETENCE AS PREDICTORS OF STUDENTS' ACHIEVEMENT IN STOICHIOMETRY

Adeleke Sunday Adesina
Department of Science Education
Faculty of Education, University of Lagos, Nigeria
Email: aadesina@unilag.edu.ng

Adedeji Tella
Department of Science and Technology Education,
Faculty of Education, University of Ibadan, Nigeria
Email: dejtell@yahoo.com

Abstract
This study determined the predictive relationship of teachers' professional identity, use of learning materials, content knowledge, competence and attitude in relation to students' achievement in stoichiometry at senior secondary school level. Using multi-stage sampling, the study sampled a total of 1.171 students and 30 teachers from public schools in Lagos State. Three research questions were raised and answered in the study. Six research instruments were used to collect data for the study. The instruments were validated and the reliability was determined using Cronbach Alpha and KR-20. The data were analysed using Pearson Product Moment Correlation and Regression at 0.05 level of significance. The findings showed that teachers' professional identity, competence, use of learning materials and pedagogical content knowledge had a significant positive relationship with students' achievement in stoichiometry while teachers' attitude had a negative relationship. The study also showed that the variables had a significant composite contribution in predicting students' achievement in stoichiometry while the relative contributions were not significant. It was therefore recommended among others, that chemistry teachers should engage students with instructional materials when teaching stoichiometry. Schools should also ensure that they provide teachers with necessary instructional materials including a well-equipped laboratory. Government should organize in-service training for teachers to develop their knowledge and competence in the instructional delivery of stoichiometry.

Introduction
Stoichiometry, an essential concept in Chemistry, allows chemists to understand the quantitative relationships between reactants and products in chemical reactions, without which chemical reactions can be incomplete. Stoichiometry helps us to determine the quantity of elements and compounds involved in a chemical reaction from a balanced chemical equation (Okanlawon, 2010). Solving stoichiometry problems to a high degree of proficiency, is necessary for handling other crucial concepts like equilibrium, chemical kinetics, thermodynamics, electrochemistry, and acid-base problems. It is considered an important instrument in the chemical toolset. Students' comprehension of the subject will have a cascading impact on students' learning of chemistry. This could further help students who are seeking to further their education in science at post-secondary level.

However, existing literature has shown that Stoichiometry always constitutes problems among Senior Secondary School (SSS) students in Nigeria owing to the abstract nature of the concept. Shedrack and Enunuwe (2018), for example, found that students struggle to identify the limiting

reagent, utilize inconsistent stoichiometry relationships, balance chemical equations poorly, and show poor understanding of theoretical yield determination and identification of substances in excess. Olatunde (2021), identified that students cannot balance chemical equations, properly identify products and reactants, and also cannot make sense of subscripts in a reaction. Researchers have linked many teacher characteristics to the achievement of students in stoichiometry. Among them are teachers' attitude and attendance at chemistry workshop (Adesoji and Olatunbosun, 2008); pedagogical content knowledge, qualification and experience (Omilani and Ime, 2018); teacher competence and teaching methods (Casinillo, 2023; Mansor, Halim and Osman 2008).

Teachers' professional identity is thought to be a crucial concept for the advancement of teaching careers. It refers to teachers' perceptions of themselves as educators, derived from their understanding of their ongoing interactions within their experiences, typically shaping their professional identity. According to Abbasian and Esmailee (2018), teachers' identity strongly correlates with students' achievement. Teachers who have a positive identity tend to be highly motivated and are committed to providing engaging and innovative learning experiences that will affect students' achievement positively. Delima (2015) reported that teachers' professional identity significantly influences teachers' performance and the students' achievement. She reported that the discovery of their professional identity forms the basis for their long-term career commitment, development and performance.

Another teacher-related factor that has been found to influence students' stoichiometry achievement is the teachers' attitude toward teaching. Heng and Karpuduwan (2015) state that attitude is a theoretical construct that expresses a person's preference for or dislike of a certain object. Teachers play crucial roles in the teaching process as students consciously or unconsciously tend to imitate the attitude demonstrated by their teachers. How teachers behave in the classroom before students, their likes and dislikes, how they feel about their subject and all other non-verbal communications could significantly impact students' achievement. Additionally, Kamal and Muideen (2014) noted that teachers' attitude strongly correlates with the achievement of the students. They assert that pupils who learned from instructors who had a more upbeat attitude outperformed their peers..

The professional competence of the teacher is one of the factors that determines the attainment of educational objectives when pursuing the realisation of a nation's intended vision (Kasim, Moonti and Sudirman, 2023). According to their definition, a teacher is competent if they are able to grasp the subject matter both thoroughly and broadly. This includes being able to master both the scientific material that underpins the curriculum and the subject matter that is covered in schools, as well as developing their scientific understanding.. Kasimi, Moonti and Sudirman (2023) reported that teacher competence significantly influences students' learning outcomes including their achievement. The higher the competence of the teachers, the better the results they achieve. Additionally, Casinillo (2023) found that teachers' competence strongly correlates with the academic achievement of students in mathematics.

In addition, examining the influence of stoichiometry pedagogical content knowledge of teachers and how it relates to students' achievement in chemistry is fundamental in any effort to comprehend how teachers teach stoichiometry and the necessary interventions to build the capacity of teachers in this area. Stoichiometry pedagogical content knowledge (SPCK) is a combination of the teacher's knowledge of the content and pedagogy in stoichiometry. It speaks of the understanding of stoichiometry that considers the unique learning requirements that are present in the idea when teaching and learning about it. According to Omilani and Ime (2018),

students' stoichiometry achievement is influenced by the PCK of the teachers in the subject. Students who had teachers with high SPCK demonstrated reduced misconceptions and improved performance. They contend that science teachers contribute significantly to students' performance because they have a say in both the content and delivery of instruction.

Another important factor that influences students' achievement in stoichiometry considered in this study is teachers' use of learning materials. Learning materials serve as a medium of delivering instructions in the classroom between the teacher and the students. Chemistry has been perceived to be an abstract subject by students, the use of learning materials demystifies this perception as it allows learners to relate with the concepts being taught in a more concrete and practical way. According to Adalikwu and Iorkpilgh (2013), there exists a statistical correlation between the utilization of learning resources by chemistry teachers and the achievement of the students. They posit that students taught with learning aids outperform their counterparts not taught with learning materials. Barcelona (2014) also noted that chemistry teachers' usage of learning resources improves their students' academic achievement in the subject. She goes on to say that using educational resources not only encourages learning but also contributes significantly to students' academic achievement.

Research Questions

1. What is the relationship between teachers' professional identity, use of learning materials, content knowledge, attitude, competence and students' achievement in stoichiometry?
2. What is the relative contribution of teachers' professional identity, use of learning materials, content knowledge, attitude, competence on students' achievement in stoichiometry?
3. What is the joint contribution of teachers' professional identity, use of learning materials, content knowledge, attitude, competence on students' achievement in stoichiometry?

Methodology

The study adopted the descriptive research design of the expost facto type. The study population is senior secondary school class two chemistry students and their teachers in the six education districts of Lagos State, Nigeria. A total of 1,701 students and 30 teachers were sampled using a multi-stage sampling method. In the first stage, stratified sampling was used to select one Local Government Area from each of the six (6) educational districts to make six (6) Local Government Areas for the study. At the second stage, purposive sampling was used to select five (5) schools from each of the Local Government Areas. The criteria for selection are that the school must be a school with a qualified chemistry teacher teaching chemistry at least in the last two sessions. Meaning that the qualified teachers must have taught the students in class one and two of senior secondary schools. Another criterion was that the chemistry syllabus for the senior secondary two must have been covered.

At the third stage, intact classes of all the chemistry students from each school were used to make up a sample of 1, 171 students. There were 486 male and 685 female participants. Their teachers were also sampled to make up 30 respondents for the study. In all, a total of 1, 201 sample was used for this study. The instrument used were Teachers' Professional Identity Scale (TPIS), Teachers' Use of Learning Materials Scale (TULMS), Teacher' Competency Scale (TCS), Teachers' Stoichiometry Pedagogical Content Knowledge Scale (TSPCKS), Teachers' Attitude Towards Stoichiometry Scale (TATSS) and Stoichiometry Achievement Test (SAT)

Teachers' Professional Identity Scale (TPIS)
The Teachers Professional Identity Scale (TPIS) adapted from the Professional Teacher Identity Scale developed by Sammons et.al (2007) was used for this study. It measured the professional identity of the chemistry teachers. It is made up of two parts. Section A asks questions on the respondent's age, gender, and name of school. Section B comprises 17 items which the respondent answered by expressing their level of agreement or disagreement on a 4-Likert Scale questions ranging from strongly agree to strongly disagree. Using Cronbach Alpha, the instrument's reliability coefficient was found to be 0.73.

Teachers' Use of Learning Materials Scale (TULMS)
The Teachers Use of Learning Materials Scale (TULMS) adapted from the Teachers' Use of Instructional Materials developed by Yazid, Abdulmumin and Jamilu (2020) was used for this study. It is made up of two parts. Section A asks questions on the respondent's gender, name of school and class. Section B is made up of 20-items which the respondent is to respond to by expressing their opinions on a 4-Likert Scale questions ranging from 1 – not like me, 2 – not much like me, 3 – somewhat like me, 4 – very much like me. Using Cronbach Alpha, the instrument's reliability coefficient was found to be 0.94.

Teacher' Competency Scale (TCS)
The Teachers Competency Scale (TCS) adopted from The Teaching Performance Assessment Template developed by the Faculty of Education; University of Ibadan was used for this study. It measured the teachers' competence as observed by trained research assistants. It is made up of two parts. Section A asks questions on the respondent's gender, name of school and class. Section B is made up of 6 categorical items with 18 sub-items which was used to assess the teachers' competence by two trained research assistants. The five rubrics for the assessment are 5 = Excellent, 4 = Very good, 3 = Good, 2 = Fair, and 1= Poor. The instrument had 83% agreement.

Teachers' Stoichiometry Pedagogical Content Knowledge Scale (TSPCKS)
The Teachers' Stoichiometry Pedagogical Content Knowledge Questionnaire developed by Malcolm (2015) was adopted for this study. It measured teachers' pedagogical content knowledge in stoichiometry. It is an open-ended questionnaire made up of two parts. The first section included information about the teachers' profile while the second section contained structured items that assessed the teachers' pedagogical content knowledge of stoichiometry concepts. The items were scored using the rubrics: 1-limited, 2 – basic, 3 – developing, 4-exemplary. The scores were collected and analysed using Guttman Split-Half, and the reliability coefficient was found to be 0.70.

Teachers' Attitude Towards Stoichiometry Scale (TATSS)
The Teachers' Attitude towards Stoichiometry Scale (TATSS) adapted from Teachers Attitude toward Biology Scale developed by Akpan (2018) was used for this study. It is made up of two parts. Section A asks questions on the respondent's gender, name of school and class. Section B is made up of 20 items which the respondent is to respond to by expressing their opinions on a 4-Likert Scale questions ranging from 1 – nothing like me, 2 – not much like me, 3 – somewhat like me, 4 – very much like me. Using Cronbach Alpha, the instrument's reliability coefficient was found to be 0.90.

Stoichiometry Achievement Test (SAT)
The study's dependent variable is the achievement of students in stoichiometry. This was measured using the Students Stoichiometry Achievement Test SAT. The aspects of stoichiometry covered in the test included mass and volume relationships and chemical equation. The test is

fifteen multiple-choice items. The options range from A to D. The reliability value of 0.81 was obtained using KR20 when the test was administered to twenty students who were not part of the main study. The difficulty index of the test ranges from 0.2-0.75, while the discrimination index is 0.2- 0.45.

Results

Relationship Between Teacher Characteristics and Students' Achievement in Stoichiometry

Table 1 shows that the relationship between teacher's professional identity ($r = 0.27$; $p < 0.05$), teachers' stoichiometry pedagogical content knowledge ($r = 0.27$; $p < 0.05$), teachers' competence($r = 0.28$; $p < 0.05$) and students' achievement in stoichiometry are positive, moderate and significant respectively. This implies that achievement of students in stoichiometry is associated with the teachers' professional identity, pedagogical content knowledge and competence. However, the relationship between students' achievement in stoichiometry and teachers' attitude ($r = -0.28$; $p < 0.05$) is negative, moderate and significant. Lastly, teachers' use of learning materials ($r = 0.13$; $p < 0.05$) has a weak, significant positive relationship with students' achievement in stoichiometry.

Composite Contribution of Teachers' Characteristics to Students' Achievement in Stoichiometry

Table 2 reveals there is a significant, composite contribution of teachers' professional identity, stoichiometry pedagogical content knowledge, competence, attitude and use of learning materials to students' achievement in stoichiometry ($F_{(5, 1200)} = 20.42$; $p < 0.05$). From table 2, the adjusted R value of 0.075 shows that the independent variables are responsible for 7.5% of the total variance in students' stoichiometry achievement. The remaining 92.5% variance is attributed to variables that are not residual in this study.

Relative Contribution of Teachers' Characteristics to Students' Achievement in Stoichiometry

Table 3 reveals that the relative contributions of teachers' professional identity ($\beta = -.055$; $t = -.447$; $p > 0.05$) use of learning materials ($\beta = -.046$; $t = -1.359$; $p > 0.05$) stoichiometry pedagogical content knowledge ($\beta = -.029$; $t = -.254$; $p > 0.05$), attitude ($\beta = -.108$; $t = -.726$; $p > 0.05$) and competence ($\beta = -.116$; $t = -.634$; $p > 0.05$) to achievement in stoichiometry are not significant.

Table 1: Relationship between the variables of the study

Pearson Correlation	Stoichiometry achievement	Professional identity	Use of material	Content knowledge	Teacher attitude	Teacher Competence
Stoichiometry achievement	1.00	.27	.13	.27	-.28	.28
Professional Identity	-.27	1.00	-.567	.80	.81	.82
Use of materials	.13	-.57	1.00	-.56	-.57	-.80
Content Knowledge	.27	.80	-.56	1.00	.81	.82
Teacher Attitude	-.28	.83	-.57	.81	1.00	.83

Table 2: Composite Contribution of Teacher Characteristics

Model	Sum of squares	Df	Mean square	F	Sig
Regression	851.860	5	170.372	20.417	0.00
Residual	9971.628	1195	8.344		
Total	10823.489	1200			

R = 0.281 Adj R^2 = 0.075

Table 3: Relative contribution of the independent variables

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.877	.389		15.114	.000
	Professional Identity	-.029	.065	-.055	-.447	.655
	Use of learning Materials	-.010	.007	-.046	-1.359	.174
	Content Knowledge	-.023	.089	-.029	-.254	.799
	Teacher Attitude	-.043	.059	-.108	-.726	.468
	Teacher Competence	0	.047	-.116	-.634	.526

Discussion and Conclusion

This study aims to determine the influence of teachers' characteristics on students' achievement in stoichiometry. The findings confirmed that teachers' professional identity (TPI) had a significant positive relationship with achievement in stoichiometry. This result implies that how teachers see themselves personally and professionally have a positive relationship with students' achievement. The more positively teachers see themselves the higher will be students' achievement. This result agrees with the findings of Abbasian and Esmailee (2018). They found that teachers with positive professional identity tend to be highly motivated and are committed to providing engaging and innovative learning experiences that will affect students' achievement positively. However, this study shows that there is no relative contribution of teachers' professional identity on students' achievement in stoichiometry. This is in contrast with the findings of Delima (2015) also found that students' achievement is predicted by the professional identity of the teacher.

In addition**,** the result of this study further showed that there exists a significant positive relationship between teachers' stoichiometry pedagogical content knowledge and students' achievement in stoichiometry. This means that an increase in the teachers' content knowledge of the teaching and learning of stoichiometry, the better the achievement of the students. This result agrees with the findings of Makhechane and Qhobela (2019) who found there is a positive correlation between teachers' pedagogical content knowledge and students' achievement in chemistry. Also, Mosabala and Rollnick (2018) discovered that teachers' pedagogical content knowledge correlates significantly with students' achievement.

More so, the result shows that teachers' pedagogical content knowledge does not predict students' achievement in stoichiometry. This result is in contrast with the findings of Omilani and Ajayi (2018), who reported that the teachers' stoichiometry pedagogical content knowledge is a predictor of students' achievement in stoichiometry. Students taught by teachers with high SPCK showed fewer misconceptions and performed better. According to them, science teachers'

influence what students are taught and how they are taught, and thus are key to students' achievement.

Furthermore, this study attests that there is a significant positive relationship between teachers' competence and students' achievement in stoichiometry. It can be deduced that the higher the competency of the teachers, the better will be the achievement of the students. The result of this study affirms the earlier discovery of Joansson, Myaberg and Rosen, (2014), that there is a significant relationship between teachers' competence and achievement. They affirm that to improve the achievement of students, there is need for teachers to invest in developing their competency. On the other hand, teachers' competence does not predict students' achievement in stoichiometry. The result aligns with the findings of Umiyanti (2017) who asserted that the competency of the teacher strongly predicts achievement of students. Asif, Shafqat, Sabahat and Zahida, (2019) also reported that teachers' competence is a predictor of students learning satisfaction and achievement.

In addition, the result of the study reveals that there's a significant positive correlation between teachers' use of learning materials and students' achievement in stoichiometry. It implies that the more teachers engage in using instructional materials in the classroom, the better will be the achievement of students. This outcome is consistent with the research conducted by Adalikwu and Iorkpilgh (2013), who found a strong positive correlation between students' stoichiometry achievement and teachers' utilization of learning resources. However, the findings show that students' achievement in stoichiometry is not predicted by teachers' use of learning materials. The result also supports the findings of Cairns and Dickson (2021) who discovered that the use instructional materials significantly with students' achievement. To improve students' achievement, chemistry teachers should make their lessons practical and applicable by using learning materials.

Also, the result of this study reveals a significant negative relationship between teachers' attitude and students' achievement in stoichiometry. One would have thought that there should be a positive correlation between these two constructs. However, this study shows a negative correlation. This implies that according to this study, when teachers demonstrate a more positive attitude to teaching stoichiometry, it does not necessarily improve the achievement of the students in stoichiometry. This could imply that teachers' attitude needs to be complemented with other factors to have a significant positive relationship with students' achievement in stoichiometry. The result of this study is in contrast with the findings of Kamal and Muideen (2014) who reported that there is a significant relationship between teachers' attitude and students' academic achievement. They posit that students who were taught by teachers with a more positive attitude performed better than their counterpart. The result also does not agree with the findings of Shittu and Oanite (2015), who found out that teachers' attitude correlates positively with students' achievement.

Recommendation

Chemistry teachers should engage students with instructional materials when teaching stoichiometry. Schools should also ensure that they provide teachers with necessary instructional materials including a well-equipped laboratory. Government should organize in-service training for teachers to develop their knowledge and competence in the instructional delivery of stoichiometry. It is believed that this will help improve the students' achievement. Government and educational stakeholders should invest in improving the welfare and conditions of service of chemistry teachers including their remuneration. This will help improve their professional identity and attitude to teaching which can cumulatively improve students' achievement in stoichiometry.

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NIGERIAN HIGHER EDUCATION SYSTEM: NEED FOR INCLUSION OF ARTIFICIAL INTELLIGENCE (AI) FOR SUSTAINABLE DEVELOPMENT

Oluwatoyin Isaiah AWOLOLA Ph. D
Department of Educational Management
Emmanuel Alayande University of Education, Oyo, Oyo State. Nigeria
awololaoi@eauedoyo.edu.ng, awoloatoyin2017@gmail.com

Bolaji Gabriel POPOOLA Ph. D
Department of Educational Management
Emmanuel Alayande University of Education, Oyo, Oyo State. Nigeria
popoolabg@eauedoyo.edu.ng / bhorlarjee@yahoo.com

Abstract
This paper investigated Nigerian Higher Education System inclusion of Artificial Intelligence (AI) for Sustainable development. It is a positional as it attempts to address the prospective assessment of AI in the Development of Nigerian higher institutions and empirical review on education and sustainable development. Becker's Human Capital Investment Theory (1975) was adopted as theoretical framework. The concepts identified include Artificial Intelligence (AI), Sustainable Development (SD) and Nigerian Higher Education System and Sustainable Development Goals. In addition, Prospective Benefits of AI in the Nigerian Higher Education System toward achieving Sustainable Development, Empirical Review on AI, Education System and Sustainable Development as well as educational Implications of AI for Education Development are highlighted. Suggestions were made that the government need to establish a clear regulatory guidelines, promoting public-private partnerships, enhancing technological infrastructure, need to support National technological advancement that could support affordable AI technology in higher education and there should be collaborative efforts between government, academia, and the private sector to drive the sustainable adoption of AI in higher education in Nigeria.

Keywords: Artificial Intelligence (AI), Higher education system, Human capital, Inclusion, Sustainable Development (SD).

Introduction
Globally, education has been referred to as the greatest force that can bring about changes. Aminu (2006) observed that the greatest investment a nation can make for the development of its economic, sociological and human resources is that of education. While sustainable development is the development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. Hence, education and sustainable development are intertwined such that good quality education drives innovation, which in turn drives economic growth and sustainable development. Nigeria like other countries of the world identifies education as a key instrument to achieving national development in the social, economic and political sectors.

Thus, the goals of education can be fully attained if the recent global invention is designed and delivered the best way in order to sharpen the minds of individuals and help transform the society to become globally competitive (Adeagbo & Awolola, 2025). However, Nigeria as a developing nation has often been linked to lack of investment in human development and problems associated

with educational reforms, i.e. churning out graduates into the 21st-century economy who intensely focused on abstract knowledge acquisition which invariably affects their employability skills.

Concept of Artificial Intelligence (AI)

Artificial Intelligence (A1) has to do with the development of systems and machines that can simulate intelligent human behavior, such as learning, reasoning, and problem-solving. It involves the use of algorithms and complex mathematical models to enable machines to learn and improve their performance autonomously and the fundamental purpose of AI is to enable machines to exhibit traits specific to human intelligence (Mircea, 2023). In the rapidly evolving landscape of education, the integration of Artificial Intelligence (AI) has emerged as a transformative force, reshaping traditional paradigms, and offering novel opportunities for personalized and efficient learning experiences. As educational institutions strive to meet the diverse needs of learners, Artificial Intelligence (AI) technologies present innovative solutions to enhance adaptability, engagement and student success.

Universally, Artificial Intelligence (AI) has been identified as a potentially less costly and far-reaching tool in the work to eradicate poverty and achieve the UN Sustainable Development Goals. However, a great deal of work needs to be done in and by developing countries to take advantage of the opportunities provided by AI and close the inequality gap. It is obvious that government cannot do it alone in this regard, hence the need to look for good alternative. Many researchers have worked on the ways to improve teaching and learning of which much attention was drawn on the teachers' adequacy and the quality of instructional materials, (Mthima, 2015). It is obvious that teachers and instructional materials would always remain inadequate and the best alternative method is the adoption of technological based teaching and learning.

Sustainable Development Goals (SDGs)

Sustainable development goals, specified by UNESCO, as necessary conditions for nations to ensure economic sustainability for human beings are: No poverty, decent work and economic growth, zero hunger, good health and well-being, quality education, gender equality, clean water and sanitation, affordable and clean energy, industry, innovation and infrastructure, reduced inequalities, sustainable cities and communities, responsible consumption and production, climate action, justice and strong institutions (UNESCO, 2017). It thus, becomes abundantly clear that most countries in Africa are still lagged in attaining the sustainable development agenda when compared to Asian Tigers developed countries such as China, India, Malaysia, South Korea, Singapore and the Western nations such as Italy, Germany, Britain, France among others that uses industrialization and education to escape the trap of poverty and build world-class economies (Aberu and Lawal, 2022).

Therefore, education becomes a fundamental objective of sustainable development and a prominence source of sustainable development indeed. An input and output of development, education is fundamental to the wider belief to expand human competences which is the pivot of development (Bruntland Commission, 1987; United Nations for Development Programmes (UNDP, 2017). At the same time, education plays a key role in the ability of a developing country to absorb modern technology and to develop the capacity for self-sustaining growth and development (Todaro & Smith, 2009) in Aberu and Lawal (2022). In other words, education holds the master key that unlocks a country's potentials towards national transformation, and sustainable human national development. There is an extensive disparity between educational standards and learning achievements in Nigeria. The system emphasizes theoretical knowledge at the expense of technical, vocational, and entrepreneurial education. School curricula almost remain unstandardized without review to make them relevant and practice oriented.

Education in Nigeria has faced several tailbacks, one of which is the poor funding. The government has not been providing adequate funds to stir up educational activities in the country. Annual budgetary estimates carry little proportions of allocation for education sector which ought to have been given more priority. UNESCO (2012) specified that developing nations should allocate at least 26 percent of their yearly budget to education. However, Nigeria is far away from attaining this benchmark specified by UNESCO, thereby impeding human development strength of the country which is supposed to activate growth and sustainable development. Thus, it is of great concerned to see countries like Kenya, Ghana, Cameroon and Equatorial Guinea overtake Nigeria in terms of educational standard, living Nigeria hopeless in integrating to the Conventional Education Strategies for Africa 2016-2025 agendum and the African Union's Agenda 2063 which sets out a pan-African vision of transformative sustainable development with the aim to transform education system for commensurate wider vision

Therefore, the paper provides a critical analysis of the relationship between education policy agenda relating to sustainable development in Nigeria's in tandem with the overall vision of African led Education for Sustainable Development (ESD) and a priority for implementing ESD in a way that is consistent with the Pan-African vision of an African Renaissance and the UNDP sustainable development goals for developing countries. Education at all levels and in all its forms constitutes a vital tool for addressing virtually all global problems. It is not only an end in itself, but also a key instrument for bringing about changes in knowledge, values, behaviours and life styles required to achieve sustainability and stability within and among countries (Aberu and Lawal (2022).

Nigerian Higher Education

Over the decades, education institutions in Nigeria 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 (Chukwuma, 2022). 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).

Nigeria is continually plagued with the underdevelopment in the educational sector which is not unconnected to the sharp decline in government funding in the sector and the low esteem placed on education in Nigeria. This has continued to have adverse effects such as dilapidation of education facilities at all levels, non-payment of teachers' salaries the various strikes actions engaged in by the universities teaching and non-teaching staff due to the worsening living and poor working conditions in the university system. Furthermore, these upheaval and unpleasant conditions resulting from government poor funding of the educational sector would no doubt produce and harvest increase rate of crime most especially cybercrime, promiscuity and declining literacy rates in the country. These outcomes therefore, reveal low or poor investment in the education sector not only having effects on the quality of education in terms of infrastructure but also on general human capital development at large in Nigeria .

Nigerian Higher Education System and Sustainable Development Goals

The Nigerian higher education system comprises an extensive network of institutions including universities, polytechnics, and colleges of education. With over 170 universities (both public and private), the system caters to a substantial and diverse student population (National Universities

Commission, 2022). This system plays a pivotal role in human resource development and socio-economic advancement within the nation. 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).

Aberu and Lawal (2022) pointed that the variations in an intellectual society have always tailored towards educational revitalization. Education for Sustainable Development (ESD) is commonly understood as education that encourages changes in knowledge, skills, values and attitudes to enable a more sustainable and just society for all. Its purpose is to allow present generations to meet their needs without impeding the future generation. National Policy on Education in the Federal Republic of Nigeria (FGN, 2014) section 5 subsection in Awolola (2019) states the following as the goals of higher education in Nigeria, to:

1. contribute to national development through high-level manpower training;
2. provide accessible and affordable quality learning opportunities in formal and informal education in response to the needs and interest of Nigerians;
3. provide high-quality career counselling and lifelong learning opportunity that prepare students with knowledge and skills for self-reliance;
4. reduce skills shortages through the production of relevant skilled workers;
5. promote and encourage scholarship, entrepreneurship and community service forge and cement national unity and;
6. promote national and international understanding and interaction.

Similarly, the philosophy and objectives of the Economics Curriculum is among several higher education curriculums identified by the National Universities Commission (NUC) to equip students with appropriate tools of analysis to tackle economic issues and contribute actively to community development. Awolola (2019) submitted that the goals of higher education as stated in the National Policy on Education (FRN, 2014) is aimed at securing national development through high-level manpower training, providing lifelong learning opportunity to prepare students with knowledge and skills for self-reliance and the encouragement of students to participate in community service in order to cement national unity.

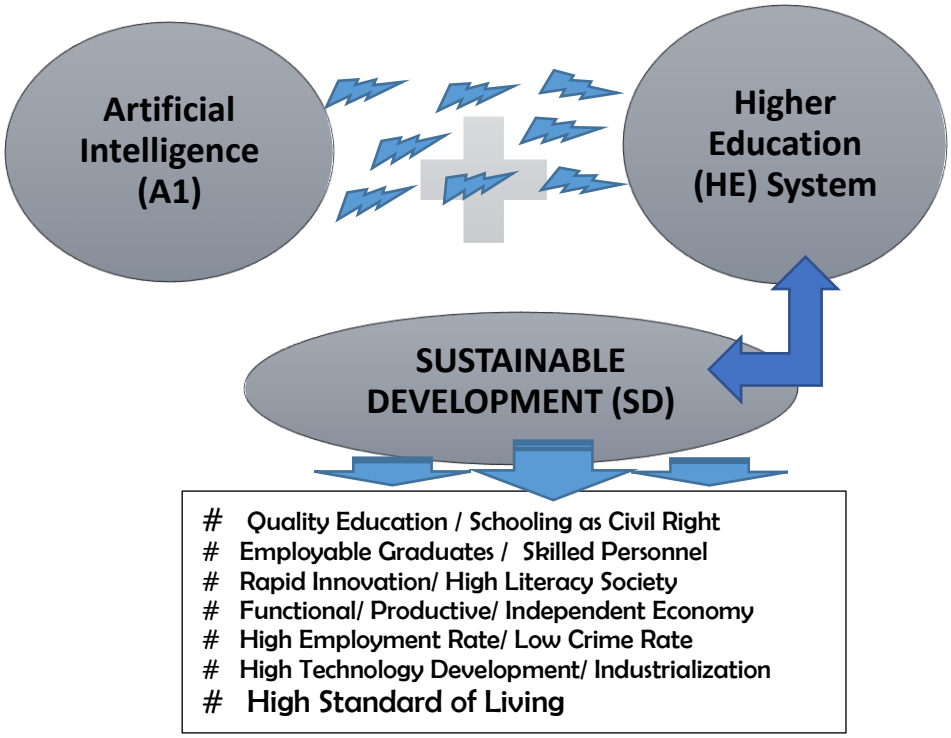


Fig.1: Relationship between Artificial Intelligence (A1), Higher Education System & Sustainable Development (SD)
Source: Author's Conceptualization (2026)

The Fig.1 displays the relationship between Artificial Intelligence (A1), education system and Sustainable Development (SD). It shows the symbiotic, interdependent relationship between the 3 variables. *In recent times, current innovations and creativity technologies have often brought new possibilities for people to be creative. However, in the school setting, it seems poor technology is a limitation to effective teaching and learning process. Thus, AI innovation promotes better education system which sustain development.*

Federal Government optional efforts toward education to attain Millennium Sustainable Development (MSD) in Nigeria cannot be overlooked. The National Policy on Education in Federal Government of Nigeria (FGN, 2014) lays great emphasis on issues of higher education. More so, United Nations Educational, Social and Cultural Organisation (UNESCO, 2019) in addition also identified five ways of promoting inclusive education in Africa toward achieving quality education in the educational settings as: Promoting positive classroom climate, embracing students‟ diversity, increasing our cultural competence, encourage student interactions and fostering a community of learners within the classes. In another contribution by Sian and Robert (2017), they noted that quality learning for sustainability can have a transformative effect in terms of promoting empowerment, leadership and wise investments in individual and collective lives. It can also regenerate the local economics of cities, making them more inclusive, safe, reliant and sustainable through inclusive education, cities can move towards achieving the UNs Sustainable Development Goals (SDGS).

Prospective Benefits of AI in the Nigerian Higher Education System toward achieving Sustainable Development

Ofem and Chukwujama (2024) supported that A1 Technology has been of beneficial to education system, they thus, identified the following:

1. **Reducing Examination Malpractices:** They explore how these technologies not only reduce examination malpractices and personalize learning but also efficiently manage large student populations, alongside other critical benefits. 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 analyze patterns in student responses to 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.

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 to diverse learning needs, which is crucial in a multicultural and economically diverse setting like Nigeria (Brooks, 2021).

3. **Detecting Plagiarism in Essays and Written:** A1 has proven to be watching detective devices for plagiarism. Simultaneously, computer vision technology monitors test-taking environments via video feeds to ensure no unauthorized materials are used. Additionally, natural language processing aids in detecting plagiarism in essays and written responses by comparing them against extensive databases of existing texts (Adams & Patel, 2023).

4. **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.

5. **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.

6. **Improving Accessibility:** 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.

7. **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).

8. **Biometric Supervision in Assessments:** 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, there by significantly reducing impersonation cases (Smith & White, 2023)..

9. **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).

10. **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.

Some Empirical Review on AI, Higher Education System and Sustainable Development

Ofem and Chukwujama (2024) on the advent of artificial intelligence (AI) in higher education presents unprecedented integrating AI-driven assessments, this study explores the potential benefits, challenges, and strategic approaches necessary for successful implementation. Drawing from global case studies in Estonia, China, the USA, and Australia, we analyze how AI has been employed to personalize learning, streamline assessment processes, and enhance educational outcomes. The findings highlight not only the transformative potential of AI in education but also the significant challenges related to fairness, privacy, and security. This study offers insights into how AI can be strategically implemented to enhance educational systems in Nigeria, ensuring that they are sustainable, equitable, and aligned with global technological advancements.

Aberu and Lawal (2022) emphasised on the essential changes in any knowledgeable and dependable social society are not unconnected to educational renaissance. The study adopted the ex-post-facto research design and utilized time series data which were sourced from CBN Statistical Bulletin from 1992 to 2021. The data were analyzed using the ARDL model to determine both the long run and short run relationships between education and sustainable development. Inferences were drawn at 5% level of significance. The estimated long run ARDL model showed that education crowd-out sustainable development in Nigeria with a negative and significant relationship. Population had a positive and significant relationship with sustainable development. Hence, the study concluded that education is significant with weaken effect on sustainable development. The study therefore recommended that the government of Nigeria should ensure quality control and result oriented policies at all levels of education in Nigeria,

educational funding in Nigeria should be adequate, conducive learning environment should be enhanced.

Ibukun and Aremo (2017) examined the long run and short run parameter among inclusive growth variables utilizing the Nigeria's annual data from 1981 to 2014, and employed both the autoregressive distributed lag model (ARDL) and Error Correction Method (ECM). They found a negative relationship between Government consumption education expenditure, and inclusive growth both in the short run and long run.

Faouzi and Othman (2017) examined the causal relationship between education expenditure and inclusive growth in Saudi Arabia from 1981-2013 using inequality adjusted human development index for inclusive growth, ratio of human resources development expenditure to GDP for education and structural Auto Regressive model of analysis. They found out that education expenditure has a positive impact on inclusive growth.

Azra (2016) in his study of measurement and determinates of inclusive growth integrated growth, inequality, accessibility and governance into one single measure. They found that macroeconomic stability and social financial deepening are important determinants to enhance inclusiveness, and reduce poverty and inequality.

Ekwueme and Ezenwa-Nebife (2016) examined education for sustainable development through academic freedom using political economy approach. They found that academic freedom leads to the expansion and discovery of new ideas of knowledge, transmits and preserves culture developed in the learner's independent judgment of an environment free from external control and domination. They further added that the educational opportunities that Nigerian children would have enjoyed through Education for all to achieve sustainability and self-reliance is lacking due to: gender equality, cultural diversity, among others.

Robert, Yuko, Nonoyama-Tarumi, Rosalyn, and Charles (2016) examined the contributions of education for sustainable development (ESD) to quality education in 18 countries. Their findings were that major themes repeated across the 18 studies, shows that ESD contributes in many ways to quality education in primary and secondary schools. Teaching and learning transforms in all contexts when the curricula include sustainability content, and ESD pedagogies promote the learning of skills, perspectives and values necessary to foster sustainable societies. The research also identified the need to integrate ESD across all subjects, to provide professional development for teachers to ensure ESD policy implementation and to adopt ESD management practices to support ESD in the curriculum in order to broaden ESD across countries.

Ilechukwu, Njoku and Ugwuozor (2014) examined education and development disconnects in Nigeria with emphasis for education for Sustainable Development (ESD) as the critical path to Nigeria's sustainable development and global competitiveness. They found that education is the pivot of national transformation and development, and added that Nigeria's dysfunctional educational system continues and deepens poverty and underdevelopment.

Theoretical Framework:

Human Capital Investment Theory (Becker, 1975)

This study adapted the Becker, 1975 Human Capital Investment Theory. The theory delineated the link among government expenditure on education and human development. Increase government spending on the education sector has the propensity to increase level of human capital

development and in turn increase sustainable development through innovation. Human capital development is generally recognized as a support for realizing wide-ranging development. Therefore, investment in education has been empirically connected to healthier economic development outcomes. Education enables poor men and women to participate in and benefit from economic growth. Hence, poor infrastructural development in education could leads to low human capital development and poor educational standard which could lead to unemployment and poverty.

Relevancy of the Theory to the Study is part of the Becker, (1975) theory that is of notion that the higher a country's budgetary for human capital development, the more the propensity to attain sustainable development goals. This theory is relevant as the goals of education can be fully attained if the recent global invention such as AI application is designed and delivered the best way in the higher institutions to sharpen the minds of individuals and help transform every society and nation at large to become globally competitive.

Universal Educational Implications of AI for Higher Education Development

According to Economic Confidential NITDA Plans Center for Artificial Intelligence, Robotics (2020), it was clarified that AI had on the personalization of learning experience. That is it can provide immediate feedback on students' works and progress, allowing for more efficient learning, provide students with additional support and guidance in specific subjects. It therefore, help to recommend or adjust learning materials based on student's knowledge level and learning style. It means AI can predict student's behavior and outcome.

More so, it offers personalized tutoring for the students. That is it creates custom learning paths for each student based on their specific strengths, weaknesses and interests. Also, AI can help the educators to identify at-risk students and intervene early. This is so as AI can analyze large amount of data related to students' performance. This means that AI can automate tasks such as grading, attendance tracking and scheduling, and thereby has influence on the efficiency of administrative tasks in higher educational institutions

In addition to these, AI can help learning more engaging and relevant for students leading to increased motivation and powered adaptive learning system can adjust the pace difficulty of learning materials, helping students to stay motivated and engaged. It means AI contributes to student engagement and motivation in learning. AI can also offer emotional support and mental health resources to the students.

More so, it enables lifelong learning and continuous development in students. It can also be used to transcribe lecturers and provide captions, helping students with hearing impairments, AI can adjust learning materials to suit the needs of students with different learning styles and help students with learning difficulty to go over a learning until they are well understood and that it translate learning materials into student's native language, making them more accessible. It also can predict the most effective learning path for each student, based on their individual learning profile.

Conclusion

The relationship between higher education and sustainable development in Nigeria need consideration. This is because higher education is a potential factor in determining sustainable development in Nigeria. For successfully implementation of AI technology systems in Nigeria, a comprehensive approach involving policy reform, infrastructure development, collaboration, and ethical considerations is essential. Integrating AI in Nigerian higher education involves navigating

various challenges. 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's overall development. Consequently, a comprehensive framework involving policy reform, infrastructure development, multi-stakeholder collaboration, and ethical considerations. By adopting these strategies, Nigerian higher education system can harness the benefits of AI to foster efficient, innovative education, avert dysfunctional economy system, miserable poverty, unemployment and underdevelopment.

Suggestions

The following suggestions are proffered for the way forward:

- Federal and state government should ensure conducive technological learning environment that would enhance students' innovation
- There is need for the government to upgrade the ICT dilapidated infrastructural facilities in the tertiary institutions.
- There is need to emphasized the importance of establishing clear regulatory guidelines, promoting public-private partnerships, enhancing technological infrastructure, and investing in local AI research and development.
- Need for the Federal Government to support National technological advancement that could support affordable AI technology in higher education.
- Collaborative efforts between government, academia, and the private sector are vital to drive the sustainable adoption of AI in higher education.
- World standard that would foster support rigorous research, and ensure that technological advancements align with the goals of Nigeria are invented into higher education system.

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HARNESSING ARTIFICIAL INTELLIGENCE (AI) FOR PERSONALIZED LEARNING: OPPORTUNITY AND CHALLENGES FOR TEACHERS IN NIGERIA

Mariam Adebusola OWOYEMI, *PhD*
Department of Curriculum Studies and Instruction.
Sikiru Adetona College of Education, Science and Technology Omu Ajose, Ogun State.
amowoyemi72@gmail.com
+2348074426301

Elinah Yemisi OLANREWAJU, *PhD*
Department of Special Education and Guidance & Counselling
Emmanuel Alayande University of Education, Oyo
olanrewajuey@eauedoyo.edu.ng
+2348025769571

Juliet Omowumi AINA
Department of Educational Management
University of Ibadan, Oyo State.
omowumijuliet27@gmail.com

Abstract
Artificial Intelligence (AI) is increasingly recognised as a powerful tool for transforming education through personalized learning. Through empirical review combined with field-based observations and case studies, this paper investigates, how AI applications engender personalized learning, emphasizing the challenges of AI in education and implications of personalized learning for the future of education. The paper is anchored on Behaviorism theoretical theory. *Human educators remain central to the learning process, bringing empathy, cultural understanding, and creativity that AI cannot replicate to ensure equitable adoption, investments in teacher training, offline or low-bandwidth tools, and community trust are essential. suggestions were made that ethical standards should steer the responsible use of AI in education, ensuring that AI tools augment rather than supplant the vital human elements of teaching and learning, policymakers should prioritize funding for technological infrastructure and professional development, create frameworks to ensure data privacy and algorithmic fairness and that governments can support the responsible integration of AI tools, enhancing the quality and accessibility of education for all students. The paper concludes that AI should be viewed as a supportive tool rather than a replacement for teachers. Suggestions were made that there is need to encompass establishing robust data protection laws, developing inclusive AI systems, investing in infrastructure to ensure equitable access to AI resources, and providing professional development for educators, ethical standards should steer the responsible use of AI in education, and that policymakers should prioritize funding for technological infrastructure and professional development, create frameworks to ensure data privacy and algorithmic fairness, and promote research into the long-term impact of AI in education.*

Keywords: Accessibility of education, Artificial intelligence, Personalized Learning, Quality

Introduction

Educational institutions have seen radical change since the advent of Artificial Intelligence (AI), including finance, healthcare, and transportation. AI technology can potentially have an outsized beneficial impact on the economy by increasing labor productivity, capital efficiency, and driving growth in sectors such as agriculture, healthcare, education, infrastructure, and energy. Artificial intelligence is a 21st century technological innovation which scholars describe in different ways. These tools empower educators, design dynamic learning environments, and deliver personalized learning experiences by utilizing data analytics, machine learning, and natural language processing (Naga and Jeevana, 2024).

However, there is likelihood to encounter some difficulties in the integration of AI tools in education even though the tools will have enhanced positive impacts in the education systems. In recent time, artificial intelligence has emerged as a powerful instrument for improving educational system. This tool was designed to imitate how a human does, such as speaking human mind, work for human based on the instruction. In essence, this technological innovation is to find a useful in all facet of life. It is find transforming various industries speedily and education is no exception of this development (Yeruva, 2023). Education sector in particular, any problem on education can be investigated on using technological tool most especially the trending one, Artificial Intelligence (AI) to find lasting solution to it. Artificial intelligence (AI), in the view of many people is the ability of machines or computers to think and act as humans do, represents the efforts towards computerized systems to imitate the human mind and actions (Wartman & Combs, 2018). AI has the potential to revolutionize the way we learn and teach, making it more personalized, engaging, and efficient, (Alneyadi, Wardat, Alshannag, and AbuAl-Aish, 2023).

Artificial Intelligence (AI) has been identified as a potentially less costly and far-reaching tool in the work to eradicate poverty and achieve the UN Sustainable Development Goals. However, a great deal of work needs to be done in and by developing countries to take advantage of the opportunities provided by AI and close the inequality gap. It is obvious that government cannot do it alone in this regard, hence the need to look for good alternative. Many researchers have worked on the ways to improve teaching and learning of which much attention was drawn on the teachers' adequacy and the quality of instructional materials, (Mthima, 2015). It is obvious that teachers and instructional materials would always remain inadequate and the best alternative method is the adoption of technological based teaching and learning. Hence, the need to investigate the need for Artificial Intelligence and its implications on the teaching and learning processes in the school system

There is less comprehensive literature on the different impacts of AI for education systems across Africa, and particularly in Nigeria, where there are structural challenges that limit the effectiveness of teaching and learning. One of such is overcrowded classrooms which has become a common reality, with teachers often responsible for 60 to 70 students at once. This situation makes individualized instruction nearly impossible, as teachers struggle to balance curriculum delivery with the diverse needs of learners. Compounding this issue are resource constraints, including shortages of textbooks, inadequate infrastructure, and limited access to digital technologies. These systemic challenges contribute to high dropout rates, low literacy levels, and uneven educational outcomes across regions (Kim & Lee, 2022).

Gao and Zhang (2023) agreed that the integration of Artificial Intelligence into education has been heralded as a potential solution to many of these challenges. AI technologies such as adaptive learning platforms, intelligent tutoring systems, and predictive analytics have been deployed in countries like China, the United States, and South Korea to personalize learning experiences.

These systems adjust content dynamically to match each student's pace, provide real-time feedback, and identify learners at risk of falling behind. Evidence from these contexts suggests that AI can improve efficiency, enhance student engagement, and support differentiated instruction.

The global enthusiasm for AI in education is also reflected in policy frameworks. UNESCO (2023) has emphasized the importance of leveraging AI to achieve Sustainable Development Goal 4, which calls for inclusive and equitable quality education for all. Governments and international organizations increasingly view AI as a tool to bridge educational gaps, particularly in low-resource settings. However, the literature also warns of risks, including algorithmic bias, data privacy concerns, and the potential displacement of teachers if AI is misused (Luckin & Cukurova, 2022). This paper engages existing literature following the themes of Concept of Artificial intelligence (AI), concept of personalized learning, AI applications in personalized learning, theoretical framework: behaviorism learning theory, challenges of ai in education, and implications/opportunity of personalized learning for the future of education.

Concept of Artificial Intelligence

Artificial Intelligence (AI) in education has been widely studied across different contexts, with scholars emphasizing both its transformative potential and its limitations. Holmes, Bialik, and Fadel (2019) argue that AI can improve efficiency by automating routine tasks such as grading, attendance, and assessment, thereby freeing teachers to focus on higher-order pedagogical activities. AI systems can provide real-time feedback to learners, enabling more personalized instruction. Similarly, Luckin (2018) stresses that AI should be understood as a complement to human intelligence rather than a replacement. She warns that overreliance on technology risks undermining the relational and empathetic dimensions of teaching, which remain central to effective learning. Holmes and Anastopoulou (2022) provided global guidance on AI in education, emphasizing ethical considerations such as data privacy, algorithmic bias, and the need for inclusive policies. The report notes that while AI can expand access to quality education, it may also exacerbate inequalities if deployed without attention to local contexts. For example, algorithms trained on data from high-income countries may not accurately reflect the realities of learners in low-resource environments, leading to biased outcomes.

Regarding technological advances in artificial intelligence (AI), stakeholders in the educational field use the AI increasingly more and more. This new technology is used by teachers, students and parents alike, to get access to more information and handle other things. Gil de Zúñiga, Goyanes & Durotoye (2023) define AI as the actual ability of non-human machines or artificial entities of doing the things (tasks, solving problems, communicating, interacting, acting logically) that we associate with biological humans. AI's functionality can be conceptualized along two dimensions: performance level (decision making / prediction) and autonomy level (varying level of human input, interaction, or supervision involved). Liu & Li (2022) considered that all citizens should learn about AI for two reasons: First, every student should know and understand what AI is and how he can use it and second all of them should be inspired to become designers of AI applications in the future. These results suggest the importance of developing AI centered educational programs for use in schools. To begin with, the AI program identifies information pertaining to career exploration, giving students exposure to different technology career opportunities and positive attitude towards these fields.

Concept of Personalized Learning

Personalized learning is critical in the Nigerian context because of the diversity of learners. Students enter classrooms with varying levels of preparedness, linguistic backgrounds, and socio-

economic circumstances. Traditional one-size-fits-all teaching approaches fail to address these differences, leaving many students disengaged or unable to keep pace. AI offers the possibility of tailoring instruction to individual needs, thereby improving learning outcomes and reducing dropout rates. Yet, the success of such initiatives depends on the readiness of teachers, the availability of infrastructure, and the establishment of ethical safeguards (Liu & Li, 2022).
In Nigeria, the urgency of personalized learning is particularly acute. The country's education system is characterized by stark inequalities between urban and rural schools. Urban centers such as Lagos have begun experimenting with AI-driven platforms, showing promising results in mathematics instruction and student retention. In contrast, rural schools in states such as Kano face persistent barriers, including unreliable electricity, poor internet connectivity, and limited teacher training. These disparities highlight the risk that AI could exacerbate existing inequalities if not implemented thoughtfully (Dede & Richards, 2023)

Artificial Intelligence (AI) is transforming education by creating personalized learning experiences tailored to individual student needs. Magna Scientia Advanced Research and Reviews (2024) submitted that unlike traditional models, which use the same curriculum for all learners, AI systems can analyze student performance in real-time and adapt the content to fit their unique learning styles and pace. Previous studies show that adaptive learning platforms increase student retention by up to 30% by providing targeted support where it's needed most (Klemke & Specht, 2023). This shift towards personalization helps ensure that learners, regardless of their abilities, receive the right level of challenge and support, enhancing their overall educational experience.

AI Applications in Personalized Learning
According to Naga and Jeevana (2024), application of AI in Personal Learning are as follows:

1. Intelligent Tutoring Systems
Intelligent Tutoring Systems (ITS) can be defined as AI-based applications that are used in facilitated instruction, where ITS increases its difficulty level as a student improves and tracks the student's learning style. Chen & Yang (2022) identified some of such organizations include the Carnegie Learning's MATHia, and Pearson's MyLab, which has been proved to enhance number of students' performances in their respective fields. This is AI tool in education. It adjusts feedback and instruction to the individual learning styles and speed of each student. Based on the requirements of the students, personalized learning platforms adapt the course material. The administrative load associated with assessment is minimized by automated grading systems. Immersion learning environments are provided by VR simulations, which improve comprehension and engagement.

2. Independent Learning Platforms
It is a way that educational content is delivered depending on each student's competencies, difficulties, and learning styles. Some examples include DreamBox Learning and Knewton, as they adapt the lessons themselves to achieve the best learning result in actual time. The exploration on AI impacts personalized learning by examining how these systems adjust learning pathways based on student behavior. Research indicates that personalized learning tools driven by AI can improve academic performance by 20% to 40%, especially in large-scale platforms such as Massive Open Online Courses.

3. Automated Grading Systems
Automated grading involves the use of technology in the assessment of students' papers and tests, where the results are availed immediately. Some of the popular tools that are being in used for

grading and moderation of different forms of assignments include the Grade scope as well as AI-grading options from Turnitin.

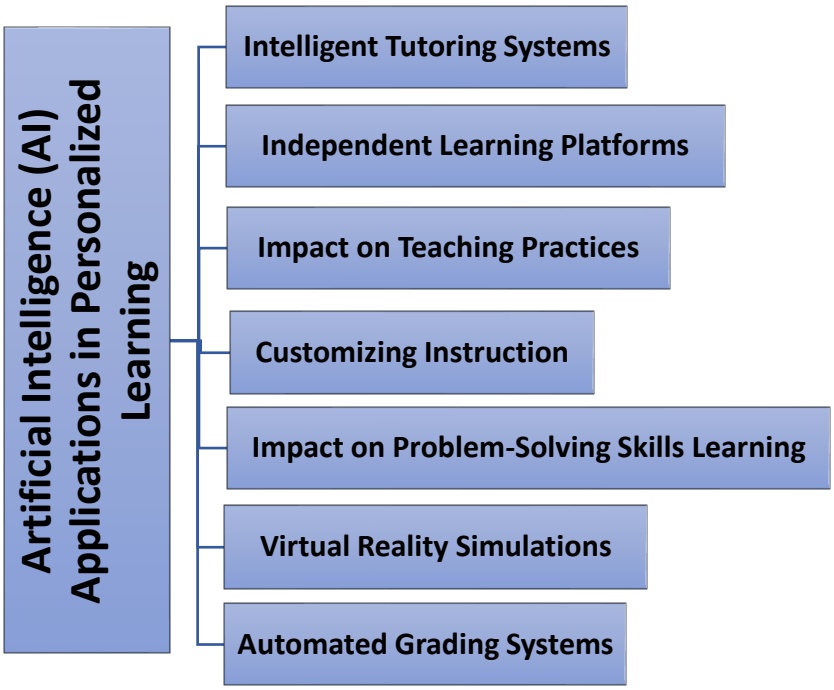


Fig. 1: Artificial Intelligence (AI) Applications in Personalized Learning
Source: Reseachers' Conceptualization (2026)

From Fig. 1, the Artificial Intelligence (AI) Applications in Personalized Learning are seen as customizing instruction, impact on problem-solving skills learning, automated grading systems, virtual reality simulations, impact on teaching practices, intelligent tutoring systems and independent learning platforms. These components are very essential for the A1 applications.

4. Virtual Reality Simulations

Virtual Reality (VR) are perhaps one of the most helpful learning models geared towards improving comprehensiveness and memorization. AI improves VR through the concept of gamification and adaptive learning environment to apply on electronics, social studies, biology, and engineering subjects. There are tools such as zSpace and Labster which allow developing practical sessions and exercises which do not have a limitation when it comes to physical resources.

5. Customizing Instruction

This caters to each student's unique needs, artificial intelligence (AI) in education enhances student engagement and retention. AI applications boost teaching efficiency by automating administrative tasks, providing data-driven insights into student performance, and promoting inclusion by making high-quality education more accessible to underserved or remote students.

6. Impact on Teaching Practices

AI tools have a big impact on teaching methods since they offer cutting-edge resources for managing the classroom and delivering instruction. Diverse student capacities can be catered to through individualized instruction made possible by ITS and Personalized Learning Platforms. The time teachers spend on difficult instructional duties is freed up by automated grading systems.

AI-driven analytics give insights into how well pupils are performing, allowing for the early detection of underachievers and the implementation of adaptable teaching methods.

7. Impact on Problem-Solving Skills Learning Outcomes

Artificial Intelligence (AI) techniques have shown promising improvements in student learning outcomes. Ngozi - Maulau (2021) pointed that Personalized learning platforms enhance retention and comprehension by tailoring content to individual student needs. Intelligent Tutoring Systems (ITS) often lead to higher test scores and enhanced problem-solving skills. Automated feedback strengthens learning by providing immediate corrective support. Virtual Reality (VR) simulations create dynamic and engaging learning environments that enrich understanding through practical application.

Theoretical Framework: Behaviorism Learning Theory

This study is anchored on Behaviorism theory, which focuses on the relationships among environmental conditions, events and behavior. Behaviorism focuses on a new behavioral pattern being repeated until it becomes automatic. Also, in order to activate learning it uses rewards and consequences when teaching the concept. One of the theorists who believed in rewarding good behavior and was able to do different experiments to proof his theory was B.F. Skinner (Mergel, 1998). Behaviorism provide understanding as regard why many students have bad attitude towards learning. Uses of A1 components can be applied to foster effective teaching and learning in the school system. This might motivate students to work harder at something, but this new knowledge would only be stored in their short term memory for they are focused on the reward instead of the learning. These bad habits motivate the learner to become lazy in learning unless there are rewards offered in exchange. Students are not been motivated to learn they are been motivated to win prices instead. The good grade should be the students' reward. In other words, students have to learn to earn good grades by studying hard; they have to see that hard work pays off rather than focusing rewards.

Challenges of Artificial Intelligence (AI) & adopting Personalized Learning in Education

Mejia and Roberts (2022) pointed that over years, educators and administrators expressed concerns about data privacy when using AI platforms, reflecting the need for stronger data governance frameworks. Additionally, The factor of resistance to AI adoption, particularly from traditional educators wary of technological shifts in education. Bias in AI algorithms by the respondents, indicating that current AI systems may not always account for diverse student needs, potentially perpetuating inequalities. Moreover, most students from rural areas reported challenges with access to reliable technology and internet, limiting the scalability of AI-driven personalized learning in less developed regions.

However, challenges such as data privacy, technological access in rural areas, and resistance to AI adoption need to be addressed to ensure broader and more equitable usage of these tools in education. Although there are advantages for each group, challenges abound; Technical problems and distractions from learning goals. Interestingly, most students identified risks associated with AI. This awareness can make gifted students more wary and skeptical about their use of AI tools, and more inclined to find solutions that work on prevention of these risks and acquire full benefits they bring to learning. From this, educational institutions would need to be clear on guidelines and give training on safe usage of AI (Shute and Wang, 2022).

Today, the challenges of applying AI in education includes issues to do with data privacy and security since the system uses large amounts of data on students' performance, data which if exposed pose high risks of being hacked. Ma and Adesope (2023), in their remarks, noted some

concerns for use. These include issues of algorithmic bias, the costs of implementation, and the continuous expenses that would be incurred after the implementation of the said tools. Due to unequal access to technology, issues like the digital gap increase educational disparities. The widespread collecting of data on student achievement raises privacy concerns. Inadequately planned and overseen algorithms have the potential to amplify already-existing inequalities.

Ng (2023) Submitted that over-reliance on AI tools may reduce the value of human engagement in the learning process. To address these problems, it is imperative to create moral standards, provide fair access, put data privacy safeguards in place, and maintain the human element of education. Further, implementing use of innovative solutions does take time, as society needs to spend plenty of time and money on the training of teachers and other staff members who will be using the software.

Some Empirical Studies

1. Farah (2025) examined gifted students in middle and secondary school in tapping artificial intelligence (AI). The first part introduces AI and its role in education and discusses how school students need to understand and use AI effectively. The second part examines the concept of giftedness and the characteristics of gifted students. The research employs a mixed-methods approach, administering questionnaires to two groups: It provides gifted students and peers with average IQs. Results show that gifted students often use AI tools (ChatGPT primarily) as tools to advance their learning and to self-explore, whereas, for non-gifted students (average IQ), AI is predominantly used for completing their homework. While all groups can see the value of AI in increasing engagement and motivation, they all also struggle with difficulties, like technical problems and privacy problems. The implications are that personalized feedback and effective inclusion of AI tools within an educational curriculum are both critical. The findings concluded that AI tools should be integrated into school curricula to boost students' ability in personalizing learning, boost learning by means of creativity, and augment technological competence of students. For AI to be effectively integrated, professional development of educators becomes very important to support students' diverse needs.
2. Naga and Jeevana (2024) concluded on the potential of Artificial Intelligence (AI) applications in education to revolutionize teaching and learning has attracted a lot of interest in recent years. This research paper presents an in-depth review of the many AI uses in education, such as virtual reality simulations, automated grading systems, intelligent tutoring systems, and personalized learning platforms. This article explores the potential that AI technologies offer to improve educational practices, including individualized instruction, better learning outcomes, and increased student engagement. It also discusses the challenges and ethical encounters that come with incorporating AI into the classroom, like algorithmic bias, data privacy issues, and the digital divide. This paper delves deeper into a several possibilities for future research and development in AI applications in education, highlighting the significance of interdisciplinary collaboration, building robust frameworks for assessment, and promoting equity and inclusivity in AI-powered learning environments.
4. Madhu, Latha and Savitha (2024) submitted that the integration of Artificial Intelligence (AI) into education is rapidly transforming traditional learning environments by enabling personalized learning experiences. This paper explores the role of AI in developing adaptive learning systems that tailor educational content and pathways to individual students' needs. By leveraging machine learning algorithms and learning analytics, AI-driven platforms dynamically adjust instructional materials based on students' performance, cognitive abilities, and engagement levels. The study examines the potential

of AI to enhance student outcomes by creating more interactive and engaging educational experiences, thus fostering better retention and comprehension. Key challenges, such as data privacy, algorithmic bias, and equitable access, are also addressed to ensure the effective deployment of AI in diverse learning environments. Through case studies and real-world examples, this research highlights how AI is reshaping education by making it more flexible, student-centered, and accessible.

5. Knewton and Carnegie (2020) in Ihejirika and Chukwu (2024) carried out a study from Asia and North America demonstrate the promise of AI-driven adaptive learning platforms. In China, large-scale experiments with AI tutors have shown improvements in mathematics and language learning outcomes, particularly in urban schools with strong infrastructure. In the United States, AI has been integrated into platforms such as which adjust content dynamically to student performance. These examples illustrate the potential of AI to personalize learning at scale, but they also highlight the importance of infrastructure and teacher training.
6. The OECD (2021) noted that Sub-Saharan Africa faces significant barriers to AI adoption, including unreliable electricity, limited internet connectivity, and inadequate teacher preparation. Federal Ministry of Education (FME, 2024) reports from pilot projects in Lagos State suggested that AI can improve mathematics instruction and reduce dropout rates, but rural schools remain disadvantaged. These findings align with broader studies on the digital divide, which show that urban schools are more likely to benefit from technological innovations than rural counterparts.
7. Garuba (2021) focused on teacher perceptions of AI. Studies in South Africa and Kenya reveal mixed attitudes: while some teachers welcome AI as a tool to reduce workload, others fear it may undermine their professional autonomy. Research by Mhlanga (2023) shows that teachers often lack confidence in using AI tools, underscoring the need for professional development programs that build digital literacy. Taken together, the literature suggests that AI has significant potential to enhance personalized learning, but its success depends on context-sensitive implementation. Infrastructure, teacher training, cultural adaptation, and ethical safeguards are recurring themes across global and African studies. This paper builds on these insights by providing empirical evidence from Nigerian classrooms, highlighting both the opportunities and challenges of AI adoption in practice.

Implications /Opportunity of Personalized Learning for the Future of Education

The integration of AI into education has the potential to transform learning environments globally. As AI continues to evolve, it may redefine the role of teachers, enabling them to focus on more creative and interpersonal aspects of education while allowing AI systems to handle data-driven insights and personalization. Long-term, AI could bridge learning gaps, offering customized education pathways to millions of students across diverse socio-economic backgrounds, even in regions where resources are traditionally limited.

This shift could reshape global education, leading to a more inclusive and efficient system (Siemon and Eckhardt, 2023). Looking ahead, future research could focus on refining AI-driven systems to ensure they are ethical and transparent, minimizing risks such as data privacy breaches or algorithmic bias. Additionally, investigating the long-term success of students who engage with AI-based learning platforms would provide insights into whether these systems foster lifelong learning habits.

Studies could also explore the scalability of AI education platforms in rural areas, such as those in Karnataka, to identify ways to bridge the digital divide and ensure equitable access to these technologies (Alblawi & Alsaadi, 2023). Involvement in teaching at the intersection of technology

and education aligns perfectly with these cutting-edge developments in AI-driven learning, as it prepares students to thrive in an evolving landscape.

Conclusion

The study reviewed AI tools in education, underscoring their ability to improve personal learning through AI. This can be seen as AI offers immense promise for personalized learning, but its success depends on empowering teachers. Training, infrastructure, and ethical safeguards are essential. Most importantly, teachers must remain at the center of education. AI can guide, but teachers inspire. AI can analyze, but teachers empathize. AI can personalize, but teachers humanize. Nonetheless, issues such as the digital divide, data privacy concerns, and algorithmic bias must be tackled to ensure fair and successful adoption.

Also, infrastructure challenges, frequent power outages and poor connectivity meant that some schools could not participate fully in pilot projects. This highlights the need for future studies to explore offline and low-bandwidth AI solutions that are more suitable for rural contexts. Ethical concerns such as data privacy and parental trust were identified but not explored in depth. Future research should investigate how negativities perceived about AI in education for personalized learning be removed, and how policies can safeguard student data processing.

Suggestions

The researchers made the following suggestions:

1. There is need to encompass establishing robust data protection laws, developing inclusive AI systems, investing in infrastructure to ensure equitable access to AI resources, and providing professional development for educators.
2. Ethical standards should steer the responsible use of AI in education, ensuring that AI tools augment rather than supplant the vital human elements of teaching and learning.
3. Policymakers should prioritize funding for technological infrastructure and professional development, create frameworks to ensure data privacy and algorithmic fairness, and promote research into the long-term impact of AI in education.
4. Policymakers can support the responsible integration of AI tools, enhancing the quality and accessibility of education for all students.
5. There is need for more personalized and integrated school curriculum, or include gamification components for learners which would help and enable them to create tools that do more than help them with academic tasks, units that support critical thinking and creativity.
6. Future research should therefore conduct large-scale, multi-regional studies across Nigeria, integrate quantitative measures of personalized learning with teacher professional development programs.

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