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Zamfara International Journal of Education (ZIJE) is the official Journal of the Faculty of Education, Federal University Gusau Zamfara State, Nigeria. The Journal publishes articles of diverse fields of interest in Education. Papers reporting original research and extended version of already established conference and journal articles are welcomed. Papers for publication are selected through peer review process to ensure originality, relevance and readability.

The aim and scope of the journal is to provide an academic medium and an important reference for the advancement and dissemination of information that supports high level learning, teaching and research in the fields of Education.

This edition, Volume 6, Number 5, August, 2026 is poised to present research reports in the following fields of education: Educational Foundations, Science Education, Educational Psychology, Curriculum & Instructional Technology, Guidance & Counselling, Philosophy & History of Education, Sociology of Education, Entrepreneurship education, Special and inclusive Education, Physical & Health Education Religious Education, Gender Studies, Peace & Security Education among Others. The articles in this volume are academic and professional discourse written by reputable scholars in their areas of specialization.

The Board wish to also acknowledge the efforts of the editorial members, for their ceaseless support towards successful publication of the journal. In the same vein, we acknowledge quite sincerely the assistance and support of our esteemed consulting editors for ensuring the credibility of this edition. Also, worthy of appreciation are the Authors and their immense contributions to this publication.

Prof. Umar Sodangi

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CALL FOR ARTICLES

The Zamfara International Journal of Education (ZIJE) calls for scholarly articles for review and possible publication in its next edition (Volume 6, Number 6, October, 2026), ZIJE publishes articles that emphasizes on research development and application within the fields of Education. All manuscripts are reviewed by editorial review committee. Contributions must be original, not previously or simultaneously published elsewhere, and are critically reviewed before they are published. Papers, which must be written in English language, should have good grammar and proper terminologies. Hence, prospective articles are subjected to plagiarism assessment test to estimate the percentage of originality of the papers. Hence, Plagiarism threshold of $\leq 20\%$ is recommended.

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1. Manuscripts including references, appendices, tables and diagrams should be double-spaced and single coded on A4 paper with generous margins (at least 1.5cm).
2. Title should be explicit and not more than 19 words.
3. Title page should be arranged as follows: Title, Author (s) full name, affiliation, full addresses, email addresses and phone numbers.
4. Abstract should be single line and not more than 250 words.
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7. Acknowledgement (if any)
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Professor Abubakar Sadiq Haruna
Publication Editor



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Assessment of Teachers' Competency on the 21st Century ... Muazu, A. M. (2026)

Assessment of Teachers' Competency on the 21st Century Curriculum Implementation among Senior Secondary Schools in Kogi East Senatorial Zone, Kogi State, Nigeria

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Abstract

This study examined the factors affecting teachers' competency in implementing the 21st century, curriculum in secondary schools across the Kogi East Senatorial Zone, Kogi State Nigeria. A descriptive survey design was employed with the target population consisting of nine local government areas that constitute Kogi East Senatorial Zone. Kogi East Senatorial Zone comprised of Ankpa, Bassa, Dekina, Idah, Olamaboro, Igalamela/Odolu, Ibaji, Omala and Ofu. A total of 270 teachers were selected using a multi stage sampling techniques to ensure a fair representation. Data were collected through a 15-item structured questionnaire developed by the researcher titled "Teachers" competency for the implementation of the 21st century curriculum among Kogi East Senatorial Zone, Kogi State, Nigeria. The instrument was validated for content and face validity by two experts in measurement and evaluation from the Faculty of Education, Prince Abubakar Audu University, Anyigba, Kogi State. Reliability was determined using the test-retest method, with a reliability coefficient calculated using Pearson's Product Moment Correlation coefficient. The questionnaire was distributed to teachers in their respective schools with support from research assistants. Data was analysed using percentages, frequency counts, and mean scores for research questions with an independent t-test employed to test the hypotheses at 0.05 level of significance. Results of the study indicated that significant barriers to teacher competency included inadequate human and material resources, insufficient commitment by teachers in the implementation process, lack of mastery of the curriculum, limited government support and funding, poor supervision and inadequate time to manage heavy workloads. The study recommended that government should increase her funding, enhanced teacher training programmes, improved supervision systems, organizing frequent workshops and seminars and better resources allocation to boost teacher competency in applying the 21st century curriculum in Kogi East Senatorial Zone, Kogi State, Nigeria.

Keywords: Assessing, teachers' competency, implementation, curriculum, 21st century.

Introduction

Education plays an immense role in a child's power of thinking by improving the cognitive development, critical thinking and also problem solving abilities (AI overview, 2025). Education is an important social development tool with its curriculum focused, defining the knowledge, skills and values imparted to the learners. With the development of societies, and which undergoes sequences of change, so does much of the educational framework, that students are better equipped to meet the needs of the day. A well -designed curriculum provides the framework of learning, while its proper execution ensures that educational implementation ensures that educational goals become functional realities (Ayodele, 2023). Curriculum and the processes used in implementing it are important to enhance the efficiency of teaching and the learning process of the students. Curriculum is the sum of structured learning experiences that students are provided with in the learning system (Ornstein & Hunkins, 2018; UNESCO, 2021). Fafunwa (2004) viewed curriculum as the whole environment in which learning takes place that involves the child, teacher, subject and the psychological environment. Curriculum is tailored to guide the teachers in imparting the nation's philosophy of education by drawing the contents in which the learner and the teacher will be engaged, so as to learn in the classroom and provide the extended learning after the classroom situation (Ayodele, 2021). It is a well-planned document that guides the selection of content, instruction, and assessment processes to achieve specific educational goals. Effective implementation of the curriculum, or putting the plans into practice in the classroom, is necessary for the achievement of these objectives (Fullan, 2007; Snyder, Bolin, & Zumwalt, 1992; Offorma, 2002; Carl, 2012). The Nigerian 21st century curriculum is aimed at providing the students with knowledge skills and attitude that is required for the learners so that they can survive in this new world. The curriculum places more emphasis on the acquisition of basic skills like critical thinking, problem -solving, communication and collaboration that are essential for survival in a complex and dynamic world (AI overview, 2025) and therefore the art of learning has become more dynamic. It requires the students to acquire more creativity and critical thinking by collaborating and by digital skills that can enable them to develop themselves and contribute more to the economic growth of Nigeria. Students are encouraged to learn in various ways (Ayodele, 2023). The implementation of the 21st -century curriculum



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requires teachers to possess higher pedagogic skills, technological proficiency, and adaptability to shifting learning environments. According to Oyinloye and Ayodele (2020), awareness and knowledge of content are sine qua non to the understanding of the subject matter itself. This curriculum that dwells on critical thinking, creativity, digital literacy, and pedagogies centered on the learners (Trilling & Fadel, 2009; Voogt & Roblin, 2012; OECD, 2019) necessitates that there is a move away from simple rote learning to more interactive and technology-centric teaching. Teachers contribute to the implementation of curriculum through classroom application of these approaches, but most are constrained by a lack of training, insufficient resources, and resistance to change (OECD, 2019). Research has shown that teacher professional development significantly contributes to teachers' ability to integrate modern teaching methods, hence improving curriculum implementation (Fullan, 2016).

Teachers' competences are the key to effective implementation of the curriculum in education. Capacities represent an intermix of knowledge, skills, attitudes, and values to teach for learning and react to curriculum innovation. Literature recently highlights that in the absence of professionally qualified and competent teachers, even the most-well-designed curricula fail to achieve intended learning outcomes. As Darling-Hammond et al. (2020) opined, curriculum and subject matter knowledge do directly influence the effective translation of curricular purposes. Teachers need to have a deep level of subject matter knowledge and teaching practice strategy in an attempt to translate curricular purposes into effective classroom practice. Similarly, OECD (2021) emphasizes that pedagogical competence of teachers, including classroom management, assessment literacy, and inclusive practices, matters in curricula adaptation to various student needs and attainment of equity in learning. In a study by Adedoyin and Soykan (2023), digital literacy was highlighted as the main driver of curriculum delivery in the modern era, particularly during the COVID19 pandemic. Teachers' competences to integrate technology into pedagogy determines the extent to which the digital and blended learning elements of the curriculum are achieved. According to Ogunyemi and Adebayo (2022), in the Nigerian context, pedagogic expertise of teachers in lesson planning, classroom observation, and contextualization is instrumental for competency-based curriculum implementation. They argue that the majority of the challenges in curriculum implementation in Africa result from inconsistencies in preparation and in-service staff development for educators. Schleicher (2020), under his OECD global education outlook, believes that curriculum attainment is dependent on teachers' capacity to interpret curriculum frameworks, relate them to the teaching resources, and provoke critical thinking among students.

In Nigeria, there are several systemic problems, from low funds and poor infrastructure to limited access to digital materials, further worsening the teachers' plight (Udoudo, 2020). In Olanrewaju et al., (2021), study, it is stated that most secondary school teachers lack the necessary competences in digital pedagogy, further increasing it being hard to provide an effective 21st-century curriculum. Besides, discrepancies in the quality of qualifications held by teachers also influence levels of competency since lower-quality teachers struggle to apply the curriculum (Ossai, & Onyekpe, 2025). Ongoing professional learning is one of the main barriers to competency for teachers. The majority of teachers learn from academic institutions with minimal exposure to models of teaching in the 21st century (Darling-Hammond et al., 2020). Their ability to adapt to evolving education models thereby remains low. Additionally, teacher education programs are usually short in addressing current learning issues, thereby equipping teachers inadequately for curriculum implementation (Gore et al., 2017). The 21st-century student is set to develop in learning, acquire sets of knowledge, literacy skills since these are component parts of what classroom experience is all about (Ayodele, 2023). The second challenge is the digital divide, and this affects teachers as well as students. Limitations in access to technological resources, such as computers, smartboards, and reliable internet connections, hinder teachers from using digital tools in teaching methods like any other (Livingstone & Helsper, 2019). Rural schools are particularly at a disadvantage because they lack the infrastructure required to support modern teaching methods (Ekor, et al., 2023). Heavy workload is another significant aspect that affects teachers' competency. Due to teachers' shortages, teachers are over-burdened with numerous hours of teaching, administrative tasks, and extra-curricular activities (Nuwaha, et al., 2023). There remains no room for self-improvement and the adaptation of innovative pedagogy. Literature indicates that overwork reduces the effectiveness and overall job satisfaction of teachers negatively (Bakker & Demerouti, 2017). Resistance to change is a competency-influencing factor in curriculum implementation.



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Teachers do not adopt new pedagogical practices due to fear of failure, poor motivation, or wariness of the efficacies of new pedagogical practices (Ertmer & Ottenbreit -Leftwich, 2019). Teachers' resistance to change is the greatest obstacle to secondary school curriculum reform when they lack support and incentives (Tondeur et al., 2017). Socio-economic status influence the performances of teachers. Low income and lack of incentives discourage teachers and discourage them from investing in professional learning (Ugwuegbulam & Adeosun, 2022). Evidence shows that if teachers are well remunerated, they will be committed to lifelong learning and enhance their teaching capacity (Hanushek & Rivkin, 2020). Parental and societal expectations also affect the ability of teachers. In most instances, educators are pressured by parents and stakeholders to emphasize success at examinations over the balanced growth of learners (Bethel -Eke & Eremie, 2020).

This culture of assessment limits the application of critical thinking and innovative learning strategies endorsed by the 21st-century curriculum (Biggs & Tang, 2018). These issues can be solved through well -informed policy interventions, increased teacher training programs, and more funding in educational technology (UNESCO, 2021). Government agencies and institutions must collaborate to provide sustainable solutions such as curriculum reforms, increased budgets, and more efficient teaching professional development programs (Ogunyinka, 2015). Learning environment is key to the success of curriculum implementation. It means physical, psychological, social, and digital conditions that encourage or inhibit teaching and learning. A good learning environment facilitates maximum student involvement, active learning, and realization of curriculum outcomes. According to Fraser (2021), a well -organized and facilitative learning environment positively impacts students' performance and motivation at school. The author corroborates the argument that classroom organization, availability of instructional materials, lighting, and temperature have effects on learners' focus and participation in class activities aligned to the curriculum. Ngussa and Makewa (2022) also believed that a positive student-centered atmosphere actively promote cooperation, interaction, and critical thinking is most effective in curriculum implementation. The instructors who establish learning environments to promote questioning and conversation are actually teaching skills and attitudes embedded in emerging curricula. Computer technology learning environments have also become more common. Bond et al. (2021) observed that the use of digital technologies in education enhances curriculum instruction by enhancing access to resources, instructional differentiation, and enabling student self -learning. They also caution that inequities in access to digital infrastructure can undermine equity in curriculum delivery. Adeyemi and Akinola (2023) note that overcrowding in classrooms, inadequate facilities, and poor infrastructure are major backlogs that undermine effective attainment of the curriculum in public schools. They recommended investment in school infrastructure and learning materials as a way of promoting objectives of the curriculum. UNESCO (2023) also highlights the importance of inclusive learning environments, with the argument that peaceful, secure, and gender -sensitive class rooms are necessary in the delivery of curricula for promoting equity and lifelong learning. This study, as such, examines these questions in Kogi East Senatorial Zone, Kogi State, Nigeria secondary schools, focusing on the influence of teachers' qualifications on curriculum implementation.

Statement of the Problem

The effective implementation of the 21st-century curriculum in secondary schools is crucial for equipping students with the skills and attitudes necessary to thrive in a rapidly changing world. However, many teachers struggle to adapt to the demands of this curriculum due to various challenges. It has been observed that some teachers lack the necessary pedagogical skills and technological proficiency required to integrate modern teaching approaches effectively. Many teachers also face difficulties in transitioning from traditional rote learning methods to student -centered and technology -driven instructional strategies. Additionally, inadequate training and limited access to professional development opportunities appear to hinder teachers' ability to implement the curriculum effectively. In some cases, teachers graduate from training institutions with minimal exposure to contemporary teaching methodologies, making it difficult for them to adjust to evolving educational standards. The lack of necessary resources, such as digital tools and infrastructural support, further complicates curriculum implementation, especially in underfunded and rural schools. Teachers' workload also seems to be a major concern, as many educators are burdened with excessive teaching hours and administrative responsibilities, leaving them with little time for self-improvement. Furthermore, resistance to change among some teachers may slow down the adoption of innovative instructional practices. Socio -economic factors, including poor remuneration and lack of incentives, may also contribute to teachers' low motivation, ultimately affecting their effectiveness in curriculum delivery. Given these observations, it is important to examine the challenges that hinder teachers from



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effectively implementing the 21st -century curriculum in secondary schools. The statement of the problem therefore is the investigation of the factors affecting the implementation of the secondary schools curriculum in Kogi East Senatorial Zone, Kogi State, Nigeria.

Research Questions

1. What is the extent of teachers' implementation of the 21st century curriculum?
2. What are the factors facing teachers' competency in implementing the 21st -century curriculum in secondary schools in Kogi East Senatorial Zone, Kogi State, Nigeria?
3. To what extent do teachers' qualifications influence the challenges they face in implementing the 21st -century curriculum?

Research Hypothesis

The following hypotheses will be tested at 0.05 level of significance

1. There is no significant difference in the challenges facing teachers' competency for implementing the 21st -century curriculum among secondary schools in Kogi East Senatorial Zone, Kogi State, Nigeria based on qualification.
2. There is no significant difference between learning environment and teachers' method of teaching.

Methodology

A descriptive survey design was employed in this study to collect data from a sample and infer characteristics of a broader population. The study sample comprised 270 secondary school teachers drawn from the nine local government area that constitute Kogi East Senatorial Zone, namely Ankpa, Bassa, Dekina, Igalamela/Odolu, Olamaboro, Omala, Ofu and Ibaji. Data collection was collected using a 20-item researcher -designed questionnaire titled Teachers' Competency for the Implementation of the 21st -Century Curriculum among Secondary Schools in Kogi East Senatorial Zone, Kogi State, Nigeria. The questionnaire was structured into two sections: Section A gathered demographic information, including gender, qualification, and years of experience, while Section B contained 15 items rated on a four -point Likert scale (Strongly Disagree = 1 to Strongly Agree = 4) to assess teachers' perceptions of curriculum implementation. To ensure validity, the instruments underwent expert review by specialists in Measurement and Evaluation at Prince Abubakar Audu University, confirming both content and face validity. Reliability was established through the test-retest method, with a two-week interval between the two administrations. The reliability coefficient was determined using Pearson's Product Moment Correlation Coefficient (PPMC) at a 0.05 significance level. And a reliability coefficient of 0.82 was obtained. For data analysis, percentages, frequency counts, and mean scores were utilized to address research questions 1 and 2. Additionally, a t-test analysis was conducted to test hypothesis 1 at a 0.05 significance level.

Presentation of Results

Research Question 1:

What is the extent of teachers' implementation of the 21st century curriculum?

Table 1: Frequency and Percentages of the extent of teachers' implementation of the 21st century curriculum

Implementation level	Frequency (f)	Percentage (%)	Ranking
To a small extent (2)	94	34.8%	1st
To a moderate extent (3)	70	25.9%	2nd
Not at all (1)	56	20.7%	3rd
To a large extent (4)	33	12.2%	4th
To a very large extent (5)	17	6.4%	5th
Total	270	100	-

Table 1 reveals that the majority of teachers implement the 21st -century curriculum to a small extent (34.7%), followed by a moderate extent (25.7%). A significant proportion (20.8%) indicated they do not implement it at all, suggesting a generally low level of curriculum adoption among teachers. Only a small percentage reported implementing it to a large extent (12.4%) or very large extent (6.4%). These findings suggest that while awareness of the 21st -century curriculum may exist, its full implementation is still limited,



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Research Question 2:

What are the challenges facing teachers' competency in implementing the 21st -century curriculum in secondary schools in Kogi East Senatorial Zone, Kogi State, Nigeria?

Table 2: Teachers' Responses to the Challenges Facing Teachers' Competence for the Implementation of 21st Century Curriculum among Secondary Schools in Kogi East Senatorial Zone, Kogi State, Nigeria

S/N	Item	Mean	SD	Skewness	Remark
1	Human and material resources are inadequate for the set -out curriculum to be implemented	3.35	0.94	-0.76	A
2	Lack of commitment, indiscipline, and poor curriculum mastery among teachers negatively impact curriculum implementation	3.24	0.94	-0.49	A
3	Inadequate funding and support from the government and school administration affect teachers' competency and curriculum implementation	3.08	1.00	-0.16	A
4	Poor supervision is one of the challenges facing teachers' competency and curriculum implementation in the 21st century	3.05	1.00	-0.10	A
5	The time allotted for implementing heavy academic loads is inadequate, affecting teachers' competency	3.02	1.00	-0.05	A

From table 2, the most significant challenge identified is the inadequacy of human and material resources, with a mean score of 3.35 and a skewness of -0.76, indicating strong agreement among respondents. Additionally, lack of commitment, indiscipline, and poor curriculum mastery among teachers emerged as a critical issue, with a mean of 3.24 and a skewness of -0.49. Inadequate funding and limited support from the government and school administration (Mean = 3.08, Skewness = -0.16) further hinder effective curriculum implementation. Poor supervision (Mean = 3.05, Skewness = -0.10) and insufficient time allocation for implementing heavy academic loads (Mean = 3.02, Skewness = -0.05) were also noted as challenges, though with slightly lower levels of agreement.

Research Question 3:

Do teachers' qualifications influence the challenges they face in implementing the 21st -century curriculum?

Table 3: Descriptive Analysis of teachers' responses on if teachers' qualifications influence the challenges they face in implementing the 21st -century curriculum

Item	Mean	SD	Skewness
Teachers with lower qualifications struggle more with integrating technology into teaching.	2.90	1.04	0.00
Higher qualifications provide teachers with better pedagogical skills for 21st-century curriculum implementation	2.85	1.03	-0.36
Teachers with higher qualifications adapt more easily to modern teaching methodologies	2.85	1.05	-0.28
Less-qualified teachers face greater difficulty in understanding and applying digital tools in the classroom	2.80	1.03	-0.79
Professional development programs help bridge the competency gap among teachers of different qualification levels	2.78	1.02	-0.79
Teachers with lower qualifications require more training and support to effectively implement the 21st-century curriculum	2.78	0.99	-0.83
There is a significant difference in curriculum implementation challenges between teachers with NCE and those with higher degrees	2.80	1.03	-0.79
Higher academic qualifications enhance teachers' ability to manage diverse classroom needs effectively	2.85	1.03	-0.36
Less -qualified teachers are more resistant to adopting innovative teaching strategies	2.85	1.05	-0.28
Government and school administrators provide equal support to teachers regardless of qualification	2.90	1.04	0.00

The results presented in Table 3 provide insight into whether teachers' qualifications influence the challenges they face in implementing the 21st -century curriculum. The responses indicate that teachers with lower qualifications tend to struggle



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more with integrating technology into teaching (Mean = 2.90, Skewness = 0.00), while higher qualifications are perceived to enhance pedagogical skills (Mean = 2.85, Skewness = -0.36) and facilitate adaptation to modern teaching methodologies (Mean = 2.85, Skewness = 0.28). Additionally, less -qualified teachers face greater challenges in understanding and applying digital tools in the classroom (Mean = 2.80, Skewness = -0.79) and require more training and support for effective curriculum implementation (Mean = 2.78, Skewness = -0.83). However, professional development programs are seen as a means to bridge these competency gaps (Mean = 2.78, Skewness = -0.79). Respondents also acknowledged a significant difference in curriculum implementation challenges between teachers with NCE and those with higher degrees (Mean = 2.80, Skewness = -0.79). Despite these disparities, some teachers believe that government and school administrators provide equal support regardless of qualification (Mean = 2.90, Skewness = 0.00). The findings suggest that while higher qualifications generally improve teachers' ability to implement the curriculum effectively, targeted professional development can help mitigate competency gaps among less -qualified teachers.

Hypothesis 1: There is no significant difference in the challenges facing teachers' competency for implementing the 21st -century curriculum among secondary schools in Kogi East Senatorial Zone, Kogi State, Nigeria based on qualification.

Table 4: t-test analysis of the difference in the challenges facing teachers' competency for implementing the 21st -century curriculum among secondary schools in Kogi East Senatorial Zone, Kogi State, Nigeria based on qualification.

Variable	No	Mean	S.D	t	df	p	Remark
Qualified	507	12.54	9.06	1.02	598	0.07	NS
Unqualified	93	11.08	8.57				

P>0.05 (Not Significant)

The results of the independent t -test presented in Table 4 examine whether there is a significant difference in the challenges facing teachers' competency for implementing the 21st-century curriculum among secondary schools in Kogi East Senatorial Zone, Kogi State, Nigeria based on qualification. The mean challenge score for qualified teachers (Mean = 12.54, SD = 9.06) was slightly higher than that of unqualified teachers (Mean = 11.08, SD = 8.57). However, the t -value (1.02) with a degree of freedom of 598 and a p -value of 0.07 indicates that the difference is not statistically significant at the 0.05 significance level. This suggests that teachers, regardless of their qualification status, experience similar challenges in implementing the 21st -century curriculum.

Hypothesis 2: There is no significant difference between learning environment and teachers' method of teaching.

Table 5: ANOVA of the significant difference between learning environment and teachers' method of teaching

Source	Sum of Squares	df	Mean Square	F	P
Between groups	18.56	2	9.28	5.42	0.005
Within groups	1462.78	857	1.71		
Total	1481.34	859			

p<0.05

The result in Table 5 shows a statistically significant difference between the learning environment and teachers' method of teaching, as indicated by the ANOVA test result (F = 5.42, p = 0.005, p < 0.05). This means that variations in the learning environment significantly influence how teachers deliver instruction.

Discussion of Findings

The findings of the study showed that the overall level of application by teachers for the 21st century curriculum is low. This suggests that many teachers are yet to fully embrace or effectively apply the key components of the 21st -century curriculum, such as learner -centered approaches, digital integration, critical thinking, collaboration, and real -world application of knowledge. This is in agreement with that of Ogunyemi and Adebayo (2022), which had identified poor teacher training, lack of resources, and lack of ongoing professional development as the usual determinants that tend to restrict effective curriculum implementation in Nigerian schools. Darling -Hammond et al. (2020) emphasized that teachers should be trained in pedagogical and technological competencies to be capable of responding to modern demands on education. This low level of implementation demonstrated in this study can be attributed to limitations such as overcrowded classrooms, poor ICT infrastructure, and insufficient institutional support. Addressing these disparities through training of teachers, improved school infrastructure, and regular curriculum -focused workshops is key to improving the adoption and success of 21st -century pedagogies.



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The findings of this study indicated that the greatest challenges to the competency of teachers to implement the 21st -century curriculum in secondary schools in Kogi East Senatorial Zone, Kogi State, Nigeria include poor human and material resources, poor commitment and grasp of the curriculum by teachers, poor funding and government support, poor supervision, and poor time allocation for managing overwhelming academic workloads. These findings are in agreement with the study of Makakole and Teane (2024), which revealed the negative impact of resource scarcity on curriculum implementation. Likewise, the issue of teachers' poor commitment and curriculum mastery is corroborated by the research of Mohamed, et al., (2022), who found that the pedagogical unpreparedness of teachers sabotages successful curriculum implementation. Further, the issue of inadequate financing and partial governmental backing aligns with Mohamad, et al., (2024) research, which identified financial limitations as one of the main hindrances to educational reform. Similarly, poor supervision affecting curriculum execution aligns with Ogunode, et al, (2020) research, who identified weak monitoring systems as a hindrance to education efficacy. Lastly, the issue of time constraints for intensive coursework is supported by the arguments of Shafiee, and Abdul (2022), who asserted that instructional time shortage negatively impacts the efficiency of teachers in delivering 21st -century skills.

The findings of this study showed that teachers who are less qualified face more challenges in applying technology and integrating digital tools into teaching, while higher qualifications enhance pedagogical skills and adaptation to modern methods. This is in conformity with the findings of Rugaiyah et al., (2024), that more qualified teachers are more competent in digital literacy and innovative pedagogy. The findings are also corroborated by Ngabonziza and Oniye (2024), who indicated that teachers who are less qualified require additional training to enable them to use technology -based teaching. Moreover, Karsiwan et al., (2021) is in conformity with these observations that the competency gaps for lower -qualified educators can be filled by professional development programs. These concurrences showed that investment in continuous professional training is the most important thing in making all educators equipped with the necessary skills to deliver the 21st -century curriculum effectively. The finding of the study also revealed that there is no variance in the challenges of teachers in teaching the 21st-century curriculum based on their qualifications. This agrees with Ossai, and Onyekpe, (2025), that both qualified and less qualified teachers have the same challenges, such as inadequate resources and poor administrative support. Similarly, the findings are corroborated by Tukurah, (2021), that institutional and professional experience factors, rather than academic qualifications, are more contributory to overcoming curriculum implementation challenges. Furthermore, Jentsch, and König, (2022)'s work is consistent with these findings, emphasizing the more critical role of continuous professional development and system support in raising the competency of teachers than formal qualifications. These alignments are indicative of the fact that it is perhaps more effective to tackle structural issues within education rather than teachers' qualifications. The research finding indicated that the quality of the environment where learning takes place affects the kind of teaching approaches embraced by educators. This is an assumption that when teachers teach in well -organized, well -equipped, and supportive environments, they are more likely to utilize varied, effective, and student -centered instructional approaches. This evidence corroborated Fraser (2021), who emphasized that effective classroom climate enhances the quality of instruction and students' interest. In the same opinion, UNESCO (2023) underscored that conducive and inclusive learning environments are essential to effective curriculum implementation and active pedagogy. Conducive learning environments tainted by overcrowded classrooms, poor facilities, or a lack of teaching aids have the tendency to limit the application of innovative or participatory pedagogies by teachers. Therefore, upgrading the quality of the learning environment is not only critical for student success but also for enabling teachers to adopt strategies in line with modern curriculum demands.

Conclusion

Based on the findings of this study, it was concluded that teachers' application of the 21st century curriculum in Kogi East Senatorial Zone, Kogi State, Nigeria is low and is responsible for a broad gap between intended curriculum and classroom practice. Based on this research, it was concluded that resource constraints, inadequate teacher preparation, overcrowding, and lack of support from institutions are key issues influencing effective implementation of the curriculum. While the qualification of teachers influences digital competence to some extent, both highly and less qualified teachers are bound by the same system constraints that restrict their ability to take up new teaching approaches. It also emerges that the quality of the classroom environment determines to a large extent the teaching approaches adopted by the teachers, with better environments resulting in interactive and student -centered approaches. To the researcher, it is preferable to break free from

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environmental and structural barriers than to highlight qualifications. Therefore, long -term professional development, enhanced funding, and effective policy implementation are vital to advancing the successful execution of the 21st -century curriculum in Nigerian secondary schools.

Recommendations

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

1. The government and school administrators should ensure the adequate provision of human and material resources to support effective curriculum implementation.
2. Regular professional development programs should be organized to enhance teachers' pedagogical skills, curriculum mastery, and technology integration.
3. Adequate funding should be allocated to education to address financial constraints that hinder teachers' competency in implementing the curriculum.
4. Educational stakeholders should enhance supervision mechanisms to ensure curriculum implementation aligns with set standards.
5. Schools should adopt better time management strategies to accommodate the heavy academic workload and improve teachers' effectiveness.
6. Regardless of their qualifications, all teachers should receive equal access to resources, mentorship, and training to bridge competency gaps.
7. Schools should invest in digital learning tools and provide necessary training to help teachers integrate technology into their teaching methods.

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Assessment of Teachers' Retention Strategies among Public Senior Secondary Schools in Sokoto, Sokoto State, Nigeria

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Abstract

Teacher retention remains a critical issue in developing educational systems due to its implications for instructional quality, organizational stability, and student achievement. This study assessed teachers' retention strategies in public senior secondary schools in Sokoto State, Nigeria. Specifically, the study examined the dimensions of retention strategies and determined the level of retention support available to teachers. The study adopted a descriptive survey design. The population comprised 7,560 teachers across 447 public senior secondary schools. A sample of 400 teachers was selected using stratified sampling techniques. Data were collected using the Teachers' Retention Strategies Questionnaire (TRSQ), which yielded a reliability coefficient of 0.65. Descriptive statistics were used to analyze the data. Findings revealed that financial incentives, promotion opportunities, professional development programmes, and staff welfare allowances significantly contribute to teacher retention. Professional development programmes emerged as the most influential retention strategy. The study concludes that comprehensive retention policies are essential for sustaining teacher commitment and enhancing educational outcomes. The study recommends increased government investment in teacher welfare, continuous professional development, and timely promotion systems.

Keywords: Teachers' retention, professional development, financial incentives, welfare, secondary education, Nigeria.

Introduction

The quality of any educational system largely depends on the availability, competence, and stability of its teaching workforce. Teachers are central to educational effectiveness because they directly influence student learning outcomes, curriculum implementation, and school improvement initiatives (Sharma & Dhar, 2016). Consequently, retaining qualified teachers has become a strategic priority for educational administrators and policymakers globally (Tehseen and Hadi, 2015). Teacher retention has emerged as a significant challenge across both developed and developing countries. Recent evidence indicates that teacher shortages are increasingly linked to rising attrition rates, inadequate compensation, excessive workloads, poor working conditions, and limited career advancement opportunities (Nguyen et al., 2022; UNESCO, 2023). In Sub-Saharan Africa, teacher attrition is particularly severe due to socioeconomic challenges, inadequate infrastructure, and limited professional support systems (UNESCO, 2023). Research by Farinde-Wu and Fitchett (2018) indicates that teacher turnover adversely affects student performance and drains school and district resources needed for recruiting, hiring, and training new educators. Strategies for retaining teachers involve understanding the factors that influence their decision to stay in their assigned schools (Tehseen and Hadi, 2015). Nigeria continues to experience teacher retention challenges, especially in public secondary schools located in rural and underserved communities. Teachers frequently encounter poor welfare conditions, delayed promotions, insufficient professional development opportunities, and inadequate financial incentives (Bryant and Allen, 2013). These factors often contribute to low job satisfaction and increased turnover intentions. Educational stakeholders have therefore emphasized the importance of teacher retention strategies aimed at improving teachers' commitment and reducing attrition. Such strategies include competitive salaries, promotion opportunities, professional development programmes, recognition systems, and staff welfare packages (Cohen, 2013). Despite increasing attention to teacher retention globally, empirical evidence on retention strategies within Nigerian public secondary schools remains limited. This study therefore examines teachers' retention strategies in public senior secondary schools in Sokoto State, Nigeria.



Objectives of the Study

The main objective of this study was to assess the teachers' retention strategies in public senior secondary in Sokoto State. Specifically, study examined the dimensions of teachers' retention strategies and the level of retention strategies provided for teachers in public senior secondary schools in Sokoto State.

Research Questions

Two research questions were raised to guide the conduct of the study.

1. What are the dimensions of teachers' retention strategies in public senior secondary schools in Sokoto State?
2. What is the level of retention strategies provided for teachers in public senior secondary schools in Sokoto State?

Conceptual Clarification

Teachers' Retention

Teacher retention refers to the ability of educational institutions to maintain qualified and experienced teachers within the profession over time. Teacher retention has become a global concern due to increasing teacher shortages and attrition rates. Recent global evidence indicates that approximately 44 million additional teachers will be required worldwide by 2030, with teacher attrition representing a major contributor to the shortage crisis UNESCO (2024).

Financial Incentives

Financial incentives refer to the practice of offering additional monetary rewards to teachers aimed at enhancing their performance (Lavy 2019, Muralidharan & Sundararaman 2020). Financial incentives include salaries, bonuses, housing allowances, transport allowances, medical benefits, pension schemes, and performance-based rewards. Robbins et al (2013) emphasized that monetary rewards serve as a powerful motivator for increasing teachers' retention.

Promotion Opportunities

Promotion refers to upward career mobility involving increased responsibilities, status, recognition, and remuneration. Promotion involves elevating teachers to positions with greater responsibilities, higher status, and increased salaries Cockcroft (2019). Haq and Islam (2015) noted that Promotions serve as positive reinforcement, enhancing teacher retention and motivating them to work harder towards educational objectives.

Professional development opportunities

Professional development refers to an ongoing process that updates teachers' knowledge, skills, and interests in their chosen fields Nakpodia (2008). Professional development encompasses workshops, conferences, seminars, mentoring, coaching, in-service training, and continuing education programmes. Given the significance of staff development and its practical implications for teachers' retention in secondary schools, staff development can be viewed as a process aimed at enhancing educators' professional knowledge, skills, and attitudes, ultimately improving student learning.

Staff Allowance

Allowances refers to fringe benefits that teachers are entitled to receive while fulfilling their roles as educators (MOES, 2013), and numerous studies have examined the relationship between teachers' job commitment and these benefits. Teacher welfare includes health services, accommodation support, transportation assistance, leave benefits, safety, workload management, and psychosocial support.

Theoretical Framework

This study is anchored on Herzberg's Two-Factor Theory (Herzberg et al., 1959). Herzberg's Two-Factor Theory posits that certain job factors lead to satisfaction, while others serve to prevent dissatisfaction. Herzberg (1959) argued that workers experience happiness and unhappiness in various situations, which influences their behaviour. These feelings can positively or negatively impact their job, leading to satisfaction for several reasons. Factors that contribute to worker unhappiness are categorized as dissatisfaction or hygiene factors such as salary, working conditions, job security, organizational policies, and interpersonal relationships. Recognition, accountability, development, achievement, responsibility, professional growth, advancement and success are all elements that contribute to job satisfaction and motivation. If such factors are met, they can avoid dissatisfaction, resulting in teacher attrition. However, if the factors are satisfied, they could positively impact the teacher's decision to stay in the profession (Chikoyo, 2018). According to Herzberg, the absence of hygiene factors creates dissatisfaction, while the presence of motivational factors promotes job satisfaction. The theory is relevant because teacher retention depends on conducive environment, welfare provisions and professional growth opportunities which can motivate teachers to stay in a school longer.



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Empirical Review (2020–2025)

See et al (2020) conducted a comprehensive review of international teacher recruitment and retention interventions. Their findings revealed that supportive working environments, professional learning opportunities, and effective school leadership were more influential than salary incentives alone in promoting teacher retention. Toropova, Myrberg and Johansson (2021). Bardach et al (2022), in their integrative review concluded that teacher motivation, self-efficacy, resilience, and psychological well-being significantly influence teachers' retention. Nguyen et al. (2022), conducted a systematic review of teacher attrition and retention studies and reported that sustained professional development programmes significantly increased teacher retention rates across educational systems. Darling-Hammond, Hyler and Gardner (2022). The Global Report on Teachers as clearly stated by UNESCO (2024) highlighted the urgent need to strengthen teacher recruitment and retention policies worldwide. The report emphasized professional development, improved working conditions, teacher well-being, and career progression as essential retention mechanisms. The OECD (2023) report found that teachers who experienced supportive school leadership and access to professional learning opportunities reported higher job satisfaction and lower turnover intentions.

Research Methodology

This study adopted a descriptive survey research design. Descriptive survey research design is a type of design that involves a systematic and comprehensive collection of information about the opinions, attitudes, feelings, belief and behaviours of respondents through observation, interview and administration of questionnaire to a relatively large representative sample of the population of interest.

Population of the Study

Population for the study entailed two levels. The first level comprised the population of all the 447 public senior secondary schools in Sokoto State, Nigeria. The second level of population comprised all the 7,560 school teachers and 447 school principals within the State. Therefore, as at the time this investigation was carried out, Sokoto State had 447 public secondary schools with 7,560 school teachers. This is shown in the Table 1 below:

Table 1: *Public Senior Secondary Schools and Teachers in Sokoto State, Nigeria*

State	No of Public Senior Secondary Schools	No of School Teachers
Sokoto State	447	7,560
Total	447	7,560

Source: *Annual School Census Report (2022/2023)*

Sample and Sampling Technique

This study employed a multi-stage sampling procedure, which combines two or more sampling techniques to ensure comprehensive data collection. At stage one, the purposive sampling was employed to select schoolteachers and their principals, as these groups were considered the primary sources of relevant and reliable information regarding teachers' retention strategies in public senior secondary schools in Sokoto State, Nigeria.

Research Instruments

Data collected for this study emanated using a research instrument which was generated from the indicators of the variables in this study. The instrument used for data collection in this study was Teachers' Retention Strategies Questionnaire (TRSQ). The instrument was administered on the selected teachers in the sampled public senior secondary schools in Sokoto State, Nigeria to ascertain the retention strategies put in place for teachers. It was divided into two Sections – A and B. Section A of the structured questionnaire was based on the demographic data of the respondents. Section B consisted of 20 items on the dimensions of the teachers' retention strategies. The questionnaire was rated on a four (4) point Likert scale ranging from Strongly Agree (SA) – 4 points, Agree (A) – 3 points, Disagree (D) – 2 points and Strongly Disagree (SD) – 1 point.

Validity of the Instrument

To ensure the validity of the research instruments, the "Teachers' Retention Strategies Questionnaire, the questionnaire underwent content, construct, and face validation by five experts. These experts were tasked with critically evaluating the items on the instruments with respect to its relevance, appropriateness, clarity of language, and alignment with the study's

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objectives and research questions. The instrument was subsequently distributed to respondents in public senior secondary schools in Sokoto State.

Reliability of the Instrument

The reliability of the instruments was assessed using the test-retest method to evaluate the consistency of the *Teachers' Retention Strategies Questionnaire*. A pilot test was conducted on 70 participants, comprising 50 teachers and 20 school principals, who were not part of the main study population. This test was carried out twice within a two-week interval in schools within Kebbi State. The scores obtained were analysed using the Pearson Product Moment Correlation (PPMC) in the Statistical Package for Social Sciences (SPSS). A reliability coefficient of 0.65 was achieved, indicating that the instrument was sufficiently reliable for data collection.

Procedure for Data Collection

With the help of three research assistants, the researcher distributed the “Teachers’ Retention Strategies Questionnaire to the sampled public senior secondary schools in Sokoto State, Nigeria. The researcher provided the research assistants with detailed instructions regarding the administration of the instruments to ensure consistency in data collection.

Method of Data Analysis

Data collected from the instruments were analysed using the Statistical Package for Social Sciences (SPSS) version 21.0. Descriptive statistics, including percentages, mean and standard deviations, were used to answer the research questions. The decision rule stipulates that items with mean scores of 2.50 or higher were accepted, while those below 2.50 were rejected. The analysis of the instrument items followed a benchmark of 2.50, derived from dividing 10 by 4, where items with mean scores of 2.50 or higher were considered high, while those below 2.50 were considered low. The research hypotheses were tested using inferential statistics of Pearson Product Moment Correlation and Multiple Regression Analysis. Multiple Regression Analysis was used to test the main hypothesis while Pearson Product Moment Correlation was used to test the operational hypothesis. All hypotheses were evaluated at a 0.05 level of significance.

Presentation of Results

Research Question 1: What are the dimensions of teachers’ retention strategies in public senior secondary schools in Sokoto State?

Table 2: *The dimensions of teachers’ retention strategies in public senior secondary schools in Sokoto State*

S/N	Statement	Mean	SD	Decision
Financial Incentives				
1	I do receive additional incentive for extra work done.	3.48	.588	High
2	I am underpaid in relation to my efforts	3.33	.627	High
3	I am satisfied with timely payment of salary	3.26	.572	High
4	My monthly salary is sufficient to satisfy all important expenses	3.30	.620	High
5	My salary enhances job commitment	3.25	.719	High
6	I get my salary on time	3.29	.780	High
7	I receive a good salary	3.36	.706	High
8	The salary I receive tallies with my qualifications.	3.28	.687	High
9	I am happy with the salary structure	3.28	.662	High
10	I get a pay increment every year.	3.33	.603	High
11	I am paid for extra time worked.	3.40	.625	High
	Average Mean	3.32	0.65	High
Promotion				
12	I am satisfied with commitments different level for my promotion.	3.24	.791	High
13	Received academic rewards from school increase my job commitment.	3.17	.749	High
14	I feel comfortable with my present level of responsibility in my teaching job	3.29	.737	High
15	The promotion process and procedures used by my employer are fair.	3.29	.704	High
16	I am comfortable with the promotion opportunities available to me as a teacher	3.42	.649	High



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17	My school's administration recognizes the good work I do.	3.23	.725	High
18	I get leave whenever I have a serious problem.	3.30	.647	High
	Average Mean	3.28	0.71	High
Professional Development Programmes				
19	Provision of job-related workshops enhance my job performance	3.58	1.05	High
20	Availability of opportunity to attend workshops outside the school increases my knowledge	3.33	.723	High
21	Provision of in-service training with in school on various issues enhances my knowledge.	3.10	.845	High
22	I am satisfied with my professional ability to perform my teaching job	3.34	.771	High
23	I am satisfied with provision of school wide experience sharing with model schools	3.30	.693	High
24	Extra responsibilities I hold at school, are appreciated	3.05	.903	High
25	My school principal attends to my social and professional problems	3.07	.905	High
26	Changing teaching profession now would be difficult for me	3.44	.765	High
27	My life would be disrupted if I change my teaching profession now	3.29	.688	High
28	I do not mix up my feeling, emotions and personal problems in the profession work	3.27	.803	High
29	I encourage other teachers to fully dedicate and commit to professional programmes.	3.21	.725	High
30	I believe that school image is my image.	3.88	.791	High
31	Teaching profession is important to my self-image	3.29	.669	High
	Average Mean	3.31	0.79	High
Staff Allowance				
32	I am satisfied with creating clean, initiating and comfortable working area.	2.48	.655	Moderate
33	I am satisfied with accessibility of transportation allowance	2.55	.602	High
34	Teaching provides me opportunity to use all skill and knowledge.	2.67	.534	High
35	I get enough recognition from educational leaders	2.63	.578	High
36	I enter the teaching profession because of its good pay	2.35	.641	Moderate
37	I always receive bonus from my school principal	3.58	.571	High
38	I share the profits generated from school projects	3.55	.590	High
39	Projects held in my school are useful towards uplifting my welfare	3.39	.578	High
40	I get medical allowances from school whenever I am sick	3.40	.636	High
41	I receive transport allowances every month.	3.41	.659	High
42	My school principal organises appropriate gifts for the good work I do.	3.41	.793	High
43	The school provides me with accommodation	3.44	.688	High
44	The school provides me with medical treatment.	3.34	.628	High
	Average Mean	3.09	0.63	High

Table 2 shows the dimensions of teachers' retention in public senior secondary schools in Sokoto State, Nigeria. The findings revealed that, the average mean of 2.97 with the standard deviation of 0.75 on the appropriate use of instructional materials, the average mean of 2.99 with the standard deviation of 0.74 was on punctuality to school/classroom while the average mean of 2.83 with the standard deviation of 0.78 on the items of classroom management. Therefore, all the average means of each indicator was greater than 2.50 bench mark mean which was accepted. This implies that the dimensions used have influenced the teachers' retention strategies in public senior secondary schools in Sokoto State, Nigeria.

Research Question 2: What is the level of retention strategies provided for teachers in public senior secondary schools in Sokoto State?



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Table 3. *Level of retention strategies provided for teachers in public senior secondary schools in Sokoto State.*

Level	Frequency	Percentage
High	81	44.3%
Moderate	70	38.2%
Low	32	17.5%
Total	183	100%

Source: *Researcher's Field Survey, 2026*

Table 3 shows the level of retention strategies provided for teachers in public senior secondary schools in Sokoto State. Out of the 183 respondents who participated in the study, 44.3% agreed that the level of teachers' retention strategies was high in public senior secondary schools in Sokoto State, Nigeria, 38.2% agreed that it was moderate while the remaining 17.5% agreed that it was low. Therefore, 44.3% constituted the majority of the respondents who agreed that the level of teachers' retention strategies was high in public senior secondary schools in Sokoto State, Nigeria.

Table 4: *Mean Ratings and Standard Deviations of Retention Strategies Provided for Teachers in Public Senior Secondary Schools in Sokoto State*

S/N	Retention Strategies	N	Mean	SD	Decision	Ranking
1	Financial Incentives	1.745	19.38	8.103	High	2 nd
2	Promotion		16.01	2.905	High	3 rd
3	Professional Development Programmes		36.72	4.632	High	1 st
4	Staff Allowance		14.84	8.244	High	4 th

Source: *Researcher's Field Survey, 2026*

Table 4 shows the mean ratings and standard deviations on the level of retention strategies provided for teachers in public senior secondary schools in Sokoto State. Professional development programmes were ranked 1st with the mean of 36.72 and standard deviation of 4.632, financial incentives was ranked 2nd with the mean of 19.38 and standard deviation of 8.103, promotion was ranked 3rd with the mean of 16.01 while staff allowance was ranked 4th with the mean of 14.84 and standard deviation of 8.244 respectively. This shows that, the level of retention strategies provided for teachers was high in public senior secondary schools in Sokoto State.

Discussion of Findings

The analysis of research question one revealed that financial incentives, promotions, professional development programs, and staff allowances were strategies implemented to retain teachers in public senior secondary schools in Sokoto State. These findings corroborate with Christians et al. (2016), who observed that higher salaries, training opportunities and promotion enhance teachers' performance, foster a sense of belonging, and strengthen solidarity among supervisors regarding teacher retention strategies. Similarly, Sharma and Gupta (2014) emphasized that salaries, promotion opportunities as stipulated in employment contracts, are an integral part of teacher retention strategies. Ahuja and Shukla (2022) also highlighted that offering incentives tied to specific goals motivate teachers to exert greater effort and enhances retention, with the incentive serving as a reward upon goal achievement. Findings on research question two revealed that level of retention strategies provided for teachers in public senior secondary schools in Sokoto State was high. This finding corroborates with the work of Geiger and Pivovarova (2018) who argued that welfare and financial incentives reduce factors that lead to teachers leaving their positions. Roland (2017) highlighted a direct link between financial incentives and teacher performance and retention, where rewards are tied to improved student outcomes. Nakacwa (2015) also stressed that monetary rewards, including salaries, bonuses, and benefits, are critical in enhancing teachers' retention.

Conclusion

The study highlights the importance teachers' retention strategies in public senior secondary schools in Sokoto State. The ability to retain teachers is essential for maintaining stability in schools, fostering a conducive learning environment and improving student learning outcomes. By implementing effective management and retention strategies including financial



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incentives, promotions, professional development, and staff allowance, schools can create an environment where teachers are motivated to stay in their positions.

Recommendations

Based on the study's findings and conclusions, the following recommendations are proposed:

1. Sokoto State Government should consistently maintain and effectively implement teacher retention strategies in public senior secondary schools across Sokoto State.
2. Sokoto State Government should ensure adequate funding of public senior secondary schools in Sokoto State to support students' academic progress and overall school development
3. Sokoto State Government should ensure that teachers should strive for increased productivity and effectiveness in their profession. This will improve their teaching experience and positively impact students' academic performance.
4. State governments should ensure that teacher's promotions are carried out promptly and timely to boost morale and motivation.
5. Sokoto State Government should ensure that teachers actively participate in professional development programmes such as workshops, seminars and conferences to strengthen their professional growth.

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Comparative Relationships Between Staff Development Programmes on Job and ... Ojo, M. B. (2026)

Comparative Relationships Between Staff Development Programmes on Job and Academic Performances among Higher Institution Staff and Students in Oyo State, Nigeria

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Abstract

The study examined the comparative effects of staff development programmes on academic staff job performance and students' academic performance in higher institutions in Oyo State. Two research questions and two null hypotheses guided the study. A descriptive survey design was used. Academic staff were selected from five higher institutions using a multistage sampling technique. Data were collected using a questionnaire. The data were analysed using multiple regression and Pearson Product Moment Correlation. The findings showed that staff development programmes such as higher degree attainment, conference attendance, workshop attendance, and in-service training jointly predict academic staff job performance. The study also revealed that staff development programmes are strong predictors of academic staff performance. In addition, there is a positive relationship between staff development programmes and students' academic performance. Based on these findings, the study recommends that academic staff should regularly participate in development programmes to improve their skills and knowledge. Institutions should create policies that support attendance at conferences and workshops at least every two years. Higher institutions should also provide funding and opportunities for both local and international training. Government, through the Ministry of Education, should organize regular training programmes for academic staff.

Keywords: Staff development programmes, staff performance, students' academic performance, higher institutions.

Introduction

Education is often seen as a necessary thing for a person to have good potential and also helps him or her to live well in the society. Education can be thought of as a very important industry that creates attitudes, skills, knowledge, and personalities that are needed for technology, growth, and production. It can also be seen as a cure for ignorance and poverty, and the main key to unlock natural resources. Education, as the process of helping a person grow so that they can help develop the society, is both formal and informal. While informal education is usually learned without much thinking and through unplanned ways, formal education is the organized type of learning that happens in schools. The Federal Republic of Nigeria (2013) sees education as the best tool for making national development happen. Nigeria, like other countries, knows that education is a spark and a way to achieve growth and progress because a country's social, economic, political, and technological progress depends a lot on its education system (Yusuf & Bello, 2021). In Nigeria, formal education is divided into primary or basic education, secondary education, and higher education. Primary or basic education is the starting point of learning, secondary education aims to prepare a person to live well in society and also for higher education. Higher education is what is learned after secondary school in universities, Polytechnics, and Colleges of Education. It also includes correspondence courses. Higher education is very important for any country because the country relies on it to provide the skilled workers needed for economic growth. Higher education has more value than any other levels of education as it prepares the recipient for different skills and professions needed for the socio-economic development of the nation. It inculcates proper value orientation for the survival of the individual in the society (Eze & Nwankwo, 2020). They further explained that higher education have the capacity to move the recipient into the upper strata of the society. The Higher education according to Ojo (2023) is the lifeblood of a nation's economy as well as the individual in the society. The goals of higher education as stated in the National Policy on Education (FRN, 2013) are: (1) Contributing to national development through higher level relevant individual and society; (2) Developing and inculcating proper values for the survival of the individual and society; (3) Developing the intellectual capability of the individuals to understand and appreciate their local and external environment; (4) Acquiring both physical and intellectual skills which will enable individuals to be self-reliant and useful members of the society; (5) Promoting and encouraging scholarship and community service; (6) Forging and commenting national unity and (7) Promoting national and international understandings and interaction.



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Through the various curricula modes of instruction and programmes as well as maintenance of minimum educational standards through appropriate institutions and agencies the philosophy and goals of higher education are made realizable. There are various bodies such as the National universities Commission (NUC), National Commission for Colleges of Education (NCCE), National Board for Technical Education (NBTE) which are saddled with the responsibility of maintaining education standard and provide the benchmark for the various courses. Furthermore, Ogunyemi, (2023) Opined that if education is supposed to impact necessary values, ethics code of behaviour, commitment and skills, it is expected to be best achieved particularly in the Universities. The United Nations Educational Scientific and Culture Organization UNESCO (2007) defines higher education as a programmes of study or training for research at the post-secondary level while defining higher education Emetaron and Enyi (2008) adopts the view that a more crucial aspect of higher education lies not so much in the physical location or institutional type but in the level and functions of the educational experience which the institution offers Higher education according to Babalola (2009) helps in the development of the students through advancement towards civilization, building and developing their capabilities.

As education is the corner stone of development, higher education is expected to create needed graduates and enhanced skills that can lead to the future generations. Ojo (2003) were of the opined that since the youths constitute the most central agents in the development process, higher education should move towards producing the kind of manpower that is responsive and relevant to the needs of the society. Therefore, higher education aims at developing the future human resources. It is necessary that higher education should be an institution that disciplines and guides in-experiences, stimulates indolence, corrects the propensity to dissipation and provides some assurances that their products are well groomed to be decently well-qualified for any duty that may be assigned to them after graduation. This therefore, underscores the value being placed on then quality and standards which encompass quality learning, resources inputs, instructional process, effective management, monitoring and evaluation as well as human resources capacity development in Nigerian University. The success or failure of any educational institution depends on the quality of teachers, especially in today's highly technological world. The expertise, skills, and confidence of teachers in coming up with original ideas will all play a significant role in how well they do their duties (Nura, 2022). The teacher of today, according to Ollor (2021) is an individual who is not only interested in students' acquired knowledge and skills but also equally involved in their total development. Thus, teachers have important role to play to adequately prepare students for their roles in the society in order to achieve set national objectives. Teachers' influence is always felt in every aspect of the society. All other professionals and workers within the society have at one time or the other passed through the tutelage of a teacher and thus whatever they now become is a direct outcome of what teachers have passed on to them (Okemakinde, Adewuyi & Alabi, 2013). Considering the crucial role of teachers in the academic achievement and overall development of students, it is imperative that teachers should possess qualities like command on the subject, moral and mental fitness, devotion to the profession and appropriate skill to perform their duties for the achievement of the coveted objectives. As stated by Hussaini, Sifawa and Uba (2023) teachers are the people who make up the major workforce in schools. They are expected to bring about the competitive difference since the success or failure of an educational organ is dependent on the quality of teachers. Teachers have to play many roles in an educational set up. They are supposed to work simultaneously as "authority figure, leader, knower, director, manager counsellor and guide"; whereas at the same time they are supposed to play such roles as friend, confidante, and parent as well (Gani, 2013). In this regard, teachers are not mere providers of knowledge and lessons in the classroom, they are also involved and interested in the wholesome development of students; they are accordingly supposed to have some qualities and characteristics like proficiency in the subject, moral health, physical and mental fitness. Teachers according to Ojo (2004) are the competitive advantage which any school may have and their performance should be taken seriously. Performance, according to Hussaini, Sifawa and Uba (2023), is the employee's job behaviour and comparing it with the formats and standards that have been determined in the organization. It has to do with providing information about the job behaviour of staff. Thus, performance can also be seen as the accomplishment of a given task measured against preset known standards of accuracy, completeness, cost and speed. Abang, Chi and Mnaw (2019) averred that teacher performance refers to observable behaviours, both verbal and non-verbal. It means the performance is a teaching behaviour of the teacher, which sometimes appears as a result or in the form of students' achievement. Chukwueze (2023) added that teachers' performance means the accomplishment of roles outlined for teachers by their employers and it involves the teaching-learning process that takes place in the classroom which include; provision and presentation of



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suitable lesson, use of appropriate methods of teaching, and use of current and proper instructional aids as well as assessment of students' performance. Academic staff performance has been one of great concern to stakeholders in education, given the deteriorating academic performance of secondary school students (Ejike, 2017). A lot of people, notable among them: parents, students, government and even teachers themselves have expressed dissatisfaction with the quality of teaching and learning that takes place in the schools. In spite of improved academic and professional qualification of teachers and huge government investment in education, secondary school system has failed to produce people who can contribute to solve the problem of the society (Chukwueze, 2023). Despite the importance of teachers in education sector, merely recruiting and selecting high-potential lecturers does not guarantee that they will perform their duties effectively. Academic staff, who do not know what to do or how to do it, cannot perform effectively even if they want to. Therefore, it is the responsibility of stakeholders to ensure that Academic staff know what to do and how to do it. Effective performance of Academic staff is essential for the success of schools as such performance, to a large extent, will depend on teachers' knowledge, skills, and confidence in originating ideas as to how best to carry out the task of the teaching job (Kalash, 2014). Hence, there is the need for teachers to be empowered in order for them to be effective and efficient. Empowerment of lecturers suggests complete changes in one's professional expertise, and involvement in decision making processes. Kimwari, Chirure and Omondi (2014) assert that an empowered individual has the skills and knowledge to act or improve in a positive way. Through Academic staff empowerment, they develop their own competence and self-discover their potential and limitations. Academic staff empowerment can be effected through staff development programmes which should aim at improving the performance academic staff of lecturers at work and for the greater responsibilities. (Bulus & Daniel 2025).

Staff development according to Bongati & Modibbo (2018) is the provisions made by the school system for improving the performance of the school personnel from initial employment to retirement. Staff development is a complex process by which an individual learns, grow and improves his abilities to professional tasks. According to James and Wendy (2016), MugNachuwba (2022) arura, Sempela and staff development of teachers is a process by which teachers review, renew and extend their commitments as change agents to the moral purposes of teaching; and by which they acquire and develop critically the knowledge, skills, planning and practice with children, young people and colleagues through each phase of their teaching lives. Adamu (2008) cited Hussaini, Sifawa and Uba (2023), asserted that staff development connotes the way and means by which staff performance needs are recognized and the extent to which leaders ensure that these needs are met. Staff development helps educators keep abreast of expanding knowledge base on education so they can continually refine their conceptual and craft skills. Staff development programmes of teachers, according to Lawal (2014), are important aspects of education process that deal with the art of acquiring skills in the teaching profession. They are essential practices that enhance subject mastery, teaching methodology and classroom management. Madumere-Obike (2017), asserted that the objective of staff development programmes is that it ensures the promotion of professional growth, helps to improve pedagogical skills, keeps teachers abreast with new knowledge, meets particular needs, such as curriculum development and orientation, helps in leadership responsibility, helps new teachers to adjust to teaching field, helps to promote mutual respect among teachers and recognizes the need for modern teaching methods. Staff development was described by Abdulmajid and Abdulmajid (2021) an effective method of increasing the knowledge of skills of teachers in order to enable them to teach more effectively. It is the important aspect of education process that deals with the art of acquiring skills in the teaching profession. They are essential practices that enhance subject mastery, teaching methodology and classroom management. The primary aims of staff development as submitted by Akinyele (2017) Ogohi, (2018), include enhancing professional competence which will also have some impact on personal growth and awareness, increasing job satisfaction and developing potentials for future work, and improving the individuals and institutions abilities to achieve their aims and objectives. The skills and competencies acquired because of prudent staff development programmes will enable the lecturers to perform optimally if not maximally. Their performance will not only enable them give efficient and proficient service alone, but will also provide the avenues for technological advancement as well as enabling the attainment of varied policies toward reaching national most expected destination compassionately. Peretomode and Chukwuma, (2014), Suggest that, the education of the teacher be made continuous, obligatory and undertaken at different periods. In Nigeria where the system of education is deregulated since 2003, couple with political interference, many institutions springing up tend to be having many unqualified and in-experienced teachers in their



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employment. So, if such are to be effective, the need to train and re-train staff becomes imperative and un-negotiable. The following objectives of staff development programme are identified to include:

1. To expose serving staff to the content and most modern methodologies of teaching.
2. To make them prepare for new roles as Administrators, Senior Inspectors, Counsellors, etc.
3. For serving workers who have to work in new areas at new levels with different types of students, there is need for in-service education to give necessary confidence and avoid trial and error.
4. Teachers with out-dated teaching techniques, substandard knowledge of subject-matter and former teachers returning to teaching after a prolonged absence would need to update their knowledge through orientation and other staff development activities.
5. It creates avenues for serving teachers to make up for their deficiencies in the area of newly-introduced subjects in the school curriculum like Computer Science, Test Construction and Evaluation Techniques, Record Keeping, Crisis Management, Peace and Conflict Studies, Coping Strategies and Caring for Special Children, First-Aid Education, Population and Gender Studies, HIV/AIDs Education among others

Staff members work together through in-service programmes such as workshops, conferences, and higher degree, seminar, symposium and study groups in areas of common interest in order to enhance their professional growth and competences. (Akpakwu, 2013). Academic staff constitute an important factor in the implementation of tertiary education curriculum. The quality of lecturers is known to be a key predictor of student's performance. Teaching as a profession demands continuous development of knowledge and ability through training programmes. Such training programmes include higher degree, conference, workshop, seminars, correspondence, and mentoring staff. (Ingersoll and Strong, 2011). Pauline (2013), notes that many people after graduation have little or no opportunity for re-training to enable them develop themselves adequately to meet the demands of their task. In this study, the researchers considered degree attainment and conference attendance as the variables of the study. This article emphasizes the importance of university degrees, as advancing one's degree is widely recognized as a key factor that influences the professional skills and effectiveness of academic staff in higher education. In universities, higher academic qualifications often provide lecturers with deeper knowledge of their subject, better teaching skills, and greater research abilities all of which lead to improved teaching and learning results. Research indicates that academic staff with higher degrees, such as master's and doctoral qualifications, tend to deliver curriculum more effectively, incorporate critical thinking into their teaching, and serve as mentors more competently than those with lower qualifications (Eze & Nwankwo, 2020). In Nigeria, earning a degree is not only necessary for career advancement but also enhances credibility and influence within the academic community (Ofojebe & Okeke, 2019). This aligns with global research showing that staff with advanced degrees are more productive in research publications, supervising students, and adopting innovative teaching methods (Adedeji & Adeyinka, 2021). Thus, studying how degree attainment affects staff performance is important for understanding how educational qualifications shape the effectiveness of universities. In addition, regularly attending workshops is another indicator of staff development. Workshops are gatherings of people working on a common topic or problem to improve their skills and share ideas. Ollor (2021) describes workshops as groups of ten to twenty-five people with shared interests who meet to enhance their skills through intensive study, research, practice, and discussion. These are interactive training sessions that include training materials and activities. According to Opuana (2016), workshops can be organized within school groups, inviting qualified instructors to serve as trainers and mentors. Supporting formal workshops with informal activities like team teaching and resource sharing among teachers greatly helps self-improvement. This approach encourages healthy debates about reforms and innovations, promotes teamwork, peer coaching, collaborative study, reflection, and action (Buba, Dahiru & Nuhu, 2022). Attending conferences also helps academic staff grow professionally (Umen & Ogbuabor, 2024). Conferences are formal meetings of people with similar interests, often lasting several days, usually held at the school level, aimed at reviewing practices and sharing ideas. Gani (2013) explains that conferences involve various education professionals discussing different topics, offering opportunities for speakers to communicate ideas and for attendees to learn from experts. Conferences give lecturers access to a wide range of ideas and knowledge, which can improve their performance. Therefore, staff development through attending conferences should be systematic and well-planned.

Afshan, Sobia, Kamran, & Nasir (2012) note that conferences are often used to address specific problems and can include sessions like lectures, panel discussions, and workshops. They play a vital role in workplaces, especially as environments



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change rapidly and information must be tailored to meet diverse needs. Musa (2016) states that conferences allow lecturers to demonstrate professionalism and understand the importance of ongoing professional learning, which enhances their work. Similarly, Okemakinde, Adewuyi, & Alabi (2013) believe that conferences foster the exchange of experiences, ideas, and practices, providing a platform for discussing tools and methods to improve school performance. Attending conferences exposes staff to a wide array of ideas that boost their performance. In-service training is also crucial for lecturers and the overall university performance (Okiror & Wintrobth, 2017). These training programs are organized for teachers already working in the field, helping them update or acquire new skills needed to perform their roles better. In-service training plays a vital role in successful educational reform by bridging the gap between experienced and prospective teachers, enabling them to meet new challenges and guide students towards higher standards of learning and personal growth (Opuana, 2016). According to Osanwonyi (2016), in-service training promotes continuous improvement among staff, standardizes training backgrounds, keeps teachers updated with new knowledge, encourages innovation, and helps them manage the demands of a changing learning environment.

Victoria, Nelson, Kazaara and Kazaara (2023) started the significant benefits of attending conferences by lecturers and teachers which include;

1. Conference attendance facilitate a process of collegiality in order to reduce lecturers isolation, and thereby enhance the prospect of nurturers beliefs and practices
2. Conference attendance provide an opportunity for participatory inputs that affects the sense of investment and consequent ownership that all participants develop toward their school
3. Attending learned conference helps in recognizing, acknowledging and rewarding individual creativity to create greater job satisfactory enhanced self-worth and professional pride in teaching
4. Teachers attendance at academic conference always helps to develop lecturers' reflective practice and problem-solving skills in teaching learning, administration and community relations
5. Lecturers will be allowed to better demonstrate their professionalism, their understanding of the ongoing need for professional training and the broader role of educators' and
6. Assist lecturers in understanding and effectively using the instructional text in the lecture room new textbooks, lecturers guides, and also support lecturers to better meet the needs of their students

According to Bamidele and Olatunji (2022), attending conferences is a vital staff development activity that introduces academic staff to current research trends, findings, and best practices within their fields. They further suggest that conference participation allows lecturers to engage in professional networking, share their research outputs, and gain exposure to innovative teaching and learning methods. Such participation enhances academic staff performance by encouraging ongoing learning, improving teaching quality, and motivating scholarly productivity. Evidence from studies shows that lecturers who attend academic conferences are more likely to incorporate new knowledge into their teaching, publish in reputable journals, and participate in collaborative research (Nkang & Asuquo, 2018; Yusuf & Bello, 2021). In the Nigerian higher education context, conferences also serve as platforms for policy dialogue and capacity building, helping academic staff align their work with national education goals and international standards (Ogunyemi, 2023). Therefore, understanding staff performance is essential for designing effective professional development policies in higher institutions.

Omar (2014) states that in-service training provides one of the most promising ways to improve instruction. Osamwonyi (2016) adds that in-service training enables lecturers to acquire new knowledge and instructional skills, focusing on creating learning environments that enhance their effectiveness in the classroom. Overall, staff development positively impacts teachers' performance, motivation, and job satisfaction. Abdulmajid and Abdulmajid (2021) emphasize that staff development programs are crucial for boosting lecturer performance by increasing their knowledge and skills. Consequently, these programs help lecturers better adapt to changes in teaching practices, improve their expertise, and ultimately enhance students' academic achievement. Based on this, the study aims to evaluate how staff development programs influence the performance of university lecturers and their students' academic outcomes.

Statement of the Problem

The performance of academic staff in Nigerian higher institutions has become a major concern. Many stakeholders, including parents, students, and government, are not satisfied with the quality of teaching and learning in universities. Despite increased investment in education and improved qualifications of lecturers, students' academic performance is still poor. To address this issue, efforts have been made to improve staff performance through staff development programmes such as conferences, workshops, and further studies. However, many institutions still face challenges such as lack of funding, limited opportunities, and poor participation of staff in these programmes. As a result, there is a need to examine whether staff development programmes actually improve academic staff performance and students' academic performance. This study therefore investigates the impact of staff development programmes on academic staff and students in Oyo State higher institutions.

Purpose of the Study

The main purpose of the study is to assess the impact of staff development programmes on academic staff performance and students' academic performance in South-west Nigeria.

Research Questions

The study was guided by the following research questions

1. What is the relative impact of independent variables (higher degree attainment, academic conference attendance, workshop attendance and in-service training) on academic staff job performance in Oyo State higher institutions?
2. What is the joint contribution of the independent variables (higher degree attainment, academic conference attendance, workshop attendance and in-service training) on academic staff job performance in Oyo State higher institutions?

Hypotheses

H₀₁: There is no significant relationship between staff development programmes and academic staff job performance in Oyo state higher institutions

H₀₂: There is no significant relationship between staff development programmes and students' academic performance in Oyo state higher institutions.

Research Methodology

The study used a descriptive survey research design. The study was carried out in Oyo State. The population included all academic staff in higher institutions in the state. A multistage sampling method was used. Oyo State was divided into five zones, and one institution was selected from each zones. A questionnaire titled Impact of Staff Development Programme on Academic Staff Performance Questionnaire (ISDPASPQ) was used to collect data. The instrument had two sections and used a four-point rating scale. The instrument was validated by experts and tested for reliability using Cronbach Alpha, which gave a reliability value of 0.74. Data collected were analysed using multiple regression and Pearson correlation.

Presentation of Results

Research Question 1: What is the relative impact of independent variables (higher degree attainment, academic conference attendance, workshop attendance and in-service training) on academic staff job performance in Oyo State higher institutions?

Table 1: Relative impact of independent variables (higher degree attainment, academic conference attendance, workshop attendance and in-service training) on academic staff job performance in Oyo State higher institutions

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
1	(Constant)	55.532			11.579	.000
	Interaction process	.932	.283	.255	3.288	.001
	competence					
	Teacher evaluation	.396	.234	.146	1.692	.092
	Methodology	.246	.101	.142	2.320	.018
	Instructional material usage	250	.103	.157	2.427	.016

Source: Field Survey, 2026



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Table 1 shows that four predictor factors (higher degree attainment, academic conference attendance, workshop attendance and in-service training) are potent predictors of academic staff job performance in Oyo State higher institutions. The most factor was higher degree attendance (Beta = .255, $t=3.288$, $P<0.05$), followed by in-service training (Beta=.157, $t=2.427$, $P<0.05$), and academic conference attendance (Beta=.146, $t2.320$, $P<0.01$). But academic workshop attendance is not a significant predictor of academic staff job performance (Beta=.146, $t=1.692$, $P>0.05$). This implies that higher degree attainment, in-service training and academic conference attendance will increase academic staff job performance.

Research Question 2: What is the joint contribution of the independent variables (higher degree attainment, academic conference attendance, workshop attendance and in-service training) on academic staff job performance in Oyo State higher institutions?

Table 2: summary of regression for the joint contributions of independent variables of independent variables (higher degree attainment, academic conference attendance, workshop attendance and in-service training) on academic staff job performance in Oyo State higher institutions

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	41003.287	2	20501.643	745.557	.000 ^b
	Residual	8167.033	297	27.498		
	Total	49170.320	299			

R=.913; R Square=.834; Adjusted R Square=.833; Std. Error=5.24389 Source: Field Survey, 2026

Table 2 reveals significant joint contribution of the independent variable (higher degree attainment, academic conference attendance, workshop attendance and in-service training) to then prediction of academic staff job performance. The result yielded a co-efficient of multiple regressions $R=0.913$ and multiple R-Square=.834. This suggest that the four factors combined accounted for 83.3% (Adj. $R^2=833$) variance in the prediction of academic staff job performance.

The other factors accounting for the remaining variance are beyond the scope of this study. The ANOVA result from the regression analysis shows that there was a significant impact of the independent variables on the academic staff job performance $F(2,297) = 745.557$, $P<0.01$

Testing of High Hypothesis

H₀₁: There is no significant relationship between staff development and academic staff job performance in Oyo State higher institution

Table 3: PPMC Summary showing the relationship between staff development and academic staff job performance.

Variable	N	Mean	St.Dev	Df	R	P	Sig
Academic staff job performance	300	58.1600	12.82378	298	.745**	.000	0.01
Staff development programmes	300	27.8800	4.45478				

Source: Field Survey, 2026

Table 3 reveals a significant positive relationship between staff development programmes and academic staff job performance: $r_{(298)}=.745$, $P<0.01$, $R^2=.555$. Hence null hypothesis is rejected. This implies that as a result of the staff development in Oyo State higher institutions there was an improvement in their students' academic performances.

H₀₂: There is no significant relationship between staff development and students' academic performance.

Table 4: PPMC Summary showing the relationship between staff development and students' academic performance.

Variable	N	Mean	St.Dev	Df	R	P	Sig
Students' Academic performance	300	47.0700	8.39643	298	.536	.000	<0.01
Staff development programmes	300	58.1600	12.82378				

Source: Field Survey, 2026

Table 4 reveals significant positive relationship between students' academic performance and staff development programmes, $r_{(298)}=.536$, $p<0.01$, $r^2=.287$. Hence null hypothesis is rejected. This implies that result of staff development programme has increased students' academic performance. Coefficient of determination ($r^2=.287$) reveals that teacher effectiveness accounts for 28.7% increase in students' academic performance. That is, staff development programmes had large effect in the rate of change in students' academic performance.



Discussion of Findings

This study looked at how staff development programs (like getting higher degrees, attending conferences, workshops, and in-service training) can predict how well university staff and students perform in Oyo State. The results show that staff development programs significantly help improve staff performance. This matches earlier studies, such as Akibode in Gani (2013), which found that teachers who were less committed before training became more dedicated after pursuing higher degrees. Similarly, Akinyele (2017) reported that lecturers with PhDs performed better than those with lower qualifications. However, the study also disagrees with Ikoro (2015), who found that training programs at the Federal College of Education Zaira did not effectively improve staff skills or job performance. He also noted that poor program quality contributed to staff leaving, especially experienced senior staff. The findings agree with Okemakinde, Adewuyi, and Alabi (2013), who found that attending conferences improves communication skills, knowledge, teamwork, motivation, and professional growth. Musa (2016) also supported this, saying that conferences help lecturers demonstrate professionalism and understand ongoing professional needs, which boosts their job performance. Additionally, Kheyrollah and Nasser (2012) noted that conferences provide a platform for discussing tools, technologies, and processes to improve job performance. The results also support Opuama (2016), who found that workshops positively affect teachers' performance, encouraging discussions on reforms, collaboration, peer coaching, and action plans that improve teaching quality. Furthermore, the findings agree with Omar (2014), who stated that in-service training helps teachers improve their skills and knowledge, leading to better teaching and learning outcomes. It also helps teachers face new challenges and stay professional. Mugarura Sempela and Nachuha (2022) also found that in-service training motivates teachers to continue learning through seminars and workshops. The study shows a strong link between staff development activities and better staff performance. This matches earlier research by Ogohi (2018) and Pauline (2013), which found that teachers who participate in staff development activities like conferences and workshops perform better in classroom management, teaching methods, and student assessment. However, Aroge (2012) disagreed, saying that staff development programs have limited overall effects but still influence productivity. The study also found a positive link between staff development activities and students' academic performance. This agrees with Ajai (1999) and Aremu (2000), who noted that teachers with advanced qualifications tend to help students perform better on higher-level tasks. Aremu (2000) added that competent teachers focus on clear learning outcomes, making student achievement a good way to measure teacher performance. In fact, student success is increasingly used as a key factor in evaluating teachers' effectiveness.

Conclusion

Based on the findings of this study, it was concluded that academic staff performance was positively influenced through staff development programmes such as higher degree attainment academic conference, workshop attendance and in-service training in Oyo State higher institution. It can also be concluded that staff development programmes has a significant impact on students' academic performance in Oyo State higher institutions.

Recommendations

In line with the research findings and conclusion, the following recommendations were made:

1. Academic staff should continuously be exposed to staff development programmes to update their skills and knowledge in the light of a changing educational system, so as to improve their job performance
2. There should be policy which will afford the academic staff of higher institutions in Oyo State to attending academic Conferences, workshop at least in two years interval to allow them to have better understanding of the ongoing need for professional learning and to be able to demonstrate their professionalism
3. Serving Academic staff should be encouraged to attend academic Conferences and workshops at regular interval
4. Higher institutions administrations should institutionalize regular finding and opportunities for academic staff to attend local and international. Conferences, seminars and workshops because it will enable the academic staff to stay updated in emerging trends, share knowledge, and network with peers, thereby improving job performance
5. Government through Ministry of Education in Oyo State should on regular basis organize training programmes for academic staff.



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Perception of Respect-Oriented Value Education Content on Verbal Abuse among Colleges of Education Students in Kaduna State, Nigeria

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Abstract

This study examined students' perception of value education as a strategy for reducing verbal abuse in Colleges of Education in Kaduna State, Nigeria. The study was anchored on Bandura's Social Learning Theory, which explains that behavior is learned through observation, imitation, and reinforcement. A descriptive survey design was adopted, with a sample of 312 NCE II students drawn from Federal College of Education Zaria and Kaduna State College of Education Gidan Waya using stratified and simple random sampling techniques. Data were collected using the Value Education and Verbal Abuse Questionnaire (VEVAQ) with a reliability coefficient of 0.69. Mean and standard deviation were used to answer the research question, while a one-sample t-test tested the hypothesis at 0.05 significance level. Findings showed that students perceive respect-oriented value education as an effective strategy for reducing verbal abuse. The hypothesis test revealed a significant positive perception ($t = 97.77, p < 0.05$). The study concludes that value education promotes respectful communication and reduces abusive language among students. It recommends stronger integration of value education into curricula and regular value-based programmes to promote respect and peaceful coexistence

Keywords: Students, Perception, Value Education, Verbal Abuse, Social Learning Theory

Introduction

Education serves as a fundamental pillar in individual development, with schools playing a central role in shaping students' social and communicative skills. Thus, values education is at the epicenter of the educational process because values permeate educational policies, practices, school culture, curricula, and teaching methods (Balong, Mateo, Alibal, Velasco, & Mariacos, 2024). According to Carr (2023) values profoundly shape how teachers and students view their roles and responsibilities, touching on social, emotional, and intellectual dimensions. Lumpkin (2008) cited in Clare (2024) stated that values education aims to instill a foundational set of values including honesty, respect, compassion, responsibility, and fairness that are pivotal for students' growth as individuals and as members of society'. Values guide students toward becoming well-rounded, ethical individuals capable of thoughtful decision-making, understanding the ripple effects of their actions, and valuing diverse viewpoints (Packham, Taplin, & Francis, 2024). It is crucial for nurturing students' ability to make moral judgments, empowering them to tackle ethical challenges thoughtfully, and contributing positively to their communities and the broader world (Haste, 2018). Value education helps in building moral character and helps students develop self-respect, forming the basis of current study i.e. Respect-oriented value education as a means of addressing verbal abuse. Verbal abuse is a pervasive form of psychological violence that involves the use of words, tone, or language intended to demean, intimidate, humiliate or emotionally harm another person. It occurs at various social setting including workplaces and schools. Verbal abuse in the school environment manifesting as insults, teasing, and bullying poses a significant threat to students' emotional well-being and academic performance (Juliansyah, Yuliyanto, Ardiyanti, Hidayat, Lestari, & Al Adawiyah, 2025). Verbal abuse can have severe psychological effects, such as anxiety, depression, and diminished self-confidence, it can occur not only between students but also between students and teachers. Verbal abuse in schools significantly affects students' emotional stability, self-confidence, and social interactions, leading to anxiety, depression, and reduced academic engagement (Reswita & Buulolo, 2023). Verbal abuse affects students' ability to communicate effectively, further hindering their participation in classroom discussions and social interactions. Sari (2020) stated that the perpetrator of verbal abuse often engages in blaming, labeling, or scapegoating. Verbal violence can also manifest as curses, threats, insults, intimidation, accusations, and coercion. According to Nseabasi, and Akpan (2025) most of the abusive behavior of students in educational system is due to low social confidence.

Statement of the problem

Value education plays a prominent role in shaping the behavior of learners and helping them exercise restraint in their public interactions, particularly in relation to utterances such as verbal abuse. It also fosters responsibility, respect, and the development of better citizens. However, in recent times, it has been observed that students often, at the slightest



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provocation, engage in verbal abuse toward those who offend them. In the past, various approaches have been employed to address verbal abuse among N.C.E. students in Colleges of Education, including teacher interventions, workshops, and counselling services. Despite these efforts, the problem of verbal abuse has persisted unabated. Similarly, previous research approaches have not yielded a lasting solution to the issue. Against this backdrop, this study investigates students' perception of value education as a strategy for reducing verbal abuse in Colleges of Education in Kaduna State, Nigeria

Objectives of the study

The objectives of the study was to assess student's perception on value education as a strategy for reducing verbal abuse in colleges of education in Kaduna state, Nigeria. However, the study specifically seeks to;

1. Examine student's perception on the impact of respect-oriented value education content on the reduction of verbal abuse among students in Colleges of Education in Kaduna State

Research Question

The study answered the following question below:

1. What is the extent of student's perception on the impact of respect-oriented value education content on the reduction of verbal abuse among students in Colleges of Education in Kaduna State?

Research Hypothesis

The hypothesis was formulated and tested at 0.05 alpha level of significance

H₀₁: There is no significant difference in the perception of students on the impact of respect-oriented value education content on the reduction of verbal abuse among students in Colleges of Education in Kaduna State.

Theoretical framework

The theory explaining this study is hinged on Bandura (1977) Social Learning Theory. The study posits that human behavior is acquired through observation, imitation, modelling, and reinforcement within a social environment. According to Bandura (1977) individuals learn acceptable and unacceptable behaviors by observing the actions of significant others, such as teachers, parents, peers, and community members, and by experiencing the consequences associated with those behaviors. The theory emphasizes four key processes of learning: Attention – Individuals pay attention to behaviors exhibited by role models; Retention – Observed behaviors are stored in memory; Reproduction – Individuals imitate or reproduce the observed behaviors; Motivation – Individuals are motivated to adopt behaviors that are rewarded and avoid behaviors that are punished.

Application to the Study

In the context of Colleges of Education in Kaduna State, Social Learning Theory explains how exposure to value education content can influence students' perceptions and behaviors regarding verbal abuse. Students who are taught values of respect and civility and who observe these values being practiced by lecturers and peers are likely to develop positive attitudes toward respectful communication and reject verbally abusive behavior. Therefore, the theory provides a strong framework for understanding how value education can contribute to reducing verbal abuse among students.

Conceptual issues

Values education: Refers to educators' systematic effort to instill moral, social, and ethical values in students to nurture their character and promote responsible citizenship (Berkowitz, 2011 cited in Clare, 2024)

Verbal abuse: Verbal abuse, is a form of psychological aggression that involves the use of words to humiliate, insult, or intimidate individuals. Unlike physical violence, verbal abuse does not leave visible scars, but its long-term psychological impact can be just as damaging. (Juliansyah, 2025) Verbal violence refers to abuse carried out through words, such as slander, yelling, cursing, insulting, mocking, screaming, defaming, using harsh language, and humiliating someone publicly (Erniwati & Fitriani, 2020). Mahal and Rahman (2021), state that verbal violence typically involves verbal behaviors where the perpetrator employs a communication pattern that includes insults or derogatory remarks. Abusive behaviour is the use of harshly or coarsely insulting language with the intent of hurting the feelings of another person (Ngozi and Patricia, 2018).

Review of related Empirical Studies

Nseabasi and Akpan (2025) conducted a study on school values and verbal abusive tendencies among secondary school students in Akwa Ibom South Senatorial District, Nigeria. The study adopted a correlational research design, and data were collected using a self-structured questionnaire. Data were analyzed using Pearson Product Moment Correlation (PPMC).



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The findings revealed a very high positive and significant relationship between self-discipline, humility, and abusive tendencies among students. The study is related to the present study in terms of values, verbal abusive tendencies, and the use of a structured questionnaire. However, it differs in research design and statistical tools, as the present study adopts a descriptive survey design and one-sample t-test analysis. Simon, Uwaoma, and Iwuala (2024) investigated the influence of parental verbal abuse, domiciliation, gender, and age on emotional intelligence among secondary school students in Owerri, Nigeria. The study adopted a cross-sectional survey design and used multiple regression analysis. Findings showed that parental verbal abuse, domiciliation, gender, and age were not significant predictors of emotional intelligence. The study is related to the present study in terms of verbal abuse but differs in research focus, design, and statistical tools used. Jonji and Manuel (2025) examined the impact of teaching Values Education on students' classroom behavior using a qualitative research design. Data were collected through interviews with Values Education teachers and analyzed thematically. Findings revealed that Values Education positively influences students' classroom behavior, although disruptive behaviors such as bullying and inattentiveness still occur. The study is similar to the present study in its focus on value education but differs in data collection method and research instrument. Lau, Aipipidely, and Ratu (2021) investigated verbal violence by teachers on students in a high school in Kupang City using a qualitative approach and purposive sampling of three participants. Data were analyzed through thematic procedures. Findings showed that students experienced intimidation, shame, and psychological distress, leading to absenteeism. The study is related to the present study in terms of verbal abuse but differs in sampling technique, sample size, and study population.

Research Methodology

This section presents the methodology used in carrying out the research. The study adopted descriptive survey design: The research design permits the gathering of information through the use of questionnaires from a population based on appropriate sampling techniques. Barton and Baumann (2004) opined that survey research provides a way in which to gather information on a large subset group of individuals and inferences to much larger groups. The population of the study consisted of NCE II students of Federal College of Education Zaria (FCE), and the Kaduna State College of education Gidan Waya Kafanchan (KSCOE) as shown in table 1 below.

Table 1: Distribution of Student Population

Name of College	Population of NCE II
FCEZ	1482
KSCOE	254
TOTAL	1739

Source: HOD office of the respective Institutions (2023)

In sampling out the participants of the study, the following sampling techniques were adopted: Stratified, proportionate and simple random sampling. In determining the sample size of the study, the research advisor (2006) was used. According to the table, a population of 1739 attracts a sample size of 322. Against this backdrop, the sample size of the study was 322.

Table 2: Sample by Institution

Institutions	Population	Sample Size
FCEZ	1482	275
KSCOE	254	47
TOTAL	1739	322

Source. HOD office of the respective Institutions (2023)



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The Instrumentation used for data collection used in the study was questionnaire titled Value Education and Verbal Abuse Questionnaire (VEVAQ). The instrument is made up of 10 item, the instrument was divided into two sections, section A focused on the bio-data variables of the respondents while section B was on the main test items. The instrument was validated by experts in the Social Studies, test and measurement experts and well as language experts. In order to estimate the reliability power index of the instrument, a pilot study was conducted using 30 students of the social studies Department in College of Education Nasarawa State, who are not part of the study but share similar characteristics with the participants of this study. After subjecting the 30 test items into statistical rigor, a reliability index of .69 was arrived at using Cronbach Alpha reliability statistics. According to Speigial and Martin (1991) a reliability index power that is close to 1 is considered reliable, however the one that is close to zero is less reliable. Thus, based on the reliability index or the study, the instrument is considered adequate for the main study. For statistical analysis, the study employed the use of mean and standard deviation to answer the research question and one sample t test was used to test the hypothesis at 0.05 alpha level of significance.

Presentation of Results

The chapter presents the data analysis as well as presentation of results to the study titled Student's perception on value education as a strategy for reducing verbal abuse in Colleges of Education in Kaduna state, Nigeria. The statistical package of version 26 was used to analyze the data obtained from 312 correctly filled out of the 366 that were administered to the participants of the study. The first section presented the frequency distribution of the respondents by gender, institutions and level of study. The second section answers the research questions using the frequency of items in each of the four tables. Their cumulative mean were computed and compared with a decision mean of 2.50. The null hypotheses were tested using one sample t test. All the null hypotheses were tested at 0.05 alpha level of significance.

Presentation of bio data variables

Table 3

Frequency Table

Gender	Frequency	Percent
Male	191	61.2
Female	121	38.8
Total	312	100.0

A total of 191 representing 61 % of the students are males and the rest 121 representing 38.8% are females

Table 4: level of study

	Level			Cumulative Percent
	Frequency	Percent	Valid Percent	
Level II	312	100.0	100.0	100.0

All the 312 students that took part in the study are of Level II students

Table 5

Institution	Frequency	Percent
FCOEZ	268	85.9
KSCOE	44	14.1
Total	312	100.0

A total of 268 representing 85.9% are from Federal College of Education Zaria (FCOEZ) and the rest 44 representing 14.1 are from KSCOE

Answering Research Question

Question: What is the extent of student's perception on the impact of respect-oriented value education content on the reduction of verbal abuse among students in Colleges of Education in Kaduna State?

Table 6: Test item

S/N	ITEMS:	SA	A	D	SD	Mean	STD
1.	Respect-oriented value education content has increased students' awareness of the harmful effects of verbal abuse.	120	110	40	42	2.99	1.147
2.	Lessons on respect for others have helped students communicate more politely with their peers.	102	108	49	53	2.83	0.557



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3.	Respect-oriented value education encourages students to avoid using insulting or offensive language.	114	107	39	52	2.91	1.144
4.	Exposure to respect-related values has improved mutual understanding among students.	92	102	60	58	2.73	1.162
5.	The teaching of respect for human dignity discourages the use of abusive words among students.	103	113	40	56	2.84	0.946
6.	Respect-oriented value education promotes tolerance of differing opinions without resorting to verbal attacks.	99	119	60	34	2.91	0.844
7.	Students who regularly learn respect-oriented values are less likely to engage in name-calling and ridicule.	89	90	69	64	2.65	1.004
8.	Respect-oriented value education has contributed to a more peaceful and friendly learning environment.	90	118	49	55	2.78	1.521
9.	The integration of respect-oriented values into classroom activities helps reduce conflicts that lead to verbal abuse.	92	99	70	51	2.74	1.222
10.	Respect-oriented value education motivates students to resolve disagreements through respectful dialogue rather than abusive language.	89	80	80	63	2.63	0.871
Cumulative mean						2.80	

Decision Mean =2.50

The data presented in the table 6 above were analyzed to answer the research question: "What is the extent of students' perception on the impact of respect-oriented value education content on the reduction of verbal abuse among students in Colleges of Education in Kaduna State?" All the ten questionnaire items recorded mean scores above the benchmark mean of 2.50, indicating that students generally perceived respect-oriented value education content as having a positive impact on reducing verbal abuse. Specifically, Item 1, which states that respect-oriented value education content has increased students' awareness of the harmful effects of verbal abuse, recorded the highest mean score of 2.99 (SD = 1.147), suggesting strong agreement among respondents. Similarly, Item 3 (respect-oriented value education encourages students to avoid using insulting or offensive language) and Item 6 (respect-oriented value education promotes tolerance of differing opinions without resorting to verbal attacks) both recorded mean scores of 2.91, indicating that students recognized the role of respect-based values in fostering positive interpersonal relationships and discouraging abusive communication. Based responses implies that respect-oriented value education contributes significantly to the development of courteous communication among students.

Testing of Hypotheses

Hypothesis: There is no significant difference in the perception of students on the impact of respect-oriented value education content on the reduction of verbal abuse among students in Colleges of Education in Kaduna State.

Table 7: One sample t test statistics in the student's perception on value education as a strategy for reducing verbal abuse in colleges of education in Kaduna state, Nigeria.

One-Sample Statistics

Variable	N	Mean	Std. Deviation	Mean difference	Df	T computed	T critical	P
Student's perception on the impact of respect-oriented value education content on the reduction of verbal abuse among students in Colleges of Education in Kaduna State	312	31.88	5.75	31.78	311	97.77	1.96	0.000

$$P = 0.000 < 0.05, t_{\text{computed}} = 97.77 > 1.96 \text{ at } df 311$$

The result presented in the table 7 above shows the outcome of a one-sample t-test conducted to determine whether students' perception of the impact of respect-oriented value education content on the reduction of verbal abuse among students in Colleges of Education in Kaduna State is significantly positive. Respondents (N = 312) obtained a mean score of 31.88 with a standard deviation of 5.75, suggesting a relatively high and consistent perception among students regarding the effectiveness of respect-oriented value education content in reducing verbal abuse. The computed t-value of 97.77 is



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substantially greater than the critical t-value of 1.96 at 311 degrees of freedom. Furthermore, the probability value ($p = 0.000$) is less than the 0.05 level of significance. Since the calculated p-value is less than 0.05 and the computed t-value exceeds the critical value, the null hypothesis is rejected. This indicates that there is a statistically significant positive perception among students regarding the impact of respect-oriented value education content on the reduction of verbal abuse in Colleges of Education in Kaduna State.

Summary of Finding

The followings are the summary of the major finding of the study:

1. The study found that students perceived respect-oriented value education content as an effective strategy for reducing verbal abuse among students in Colleges of Education in Kaduna State. They believe that lessons emphasizing respect, courtesy, tolerance, and positive interpersonal relationships contribute substantially to minimizing the occurrence of verbal abuse within the college environment.

Discussion of Finding

The results of the findings of the study was discussed in line with relevant literatures end review of related empirical studies: The study found that students perceive respect-oriented value education as an effective strategy for reducing verbal abuse in Colleges of Education in Kaduna State. They believe that lessons on respect, courtesy, tolerance, empathy, and positive relationships help minimize verbal abuse and promote harmonious interaction. This finding aligns with Jonji and Manuel (2025), who reported that Values Education improves students' behavior and reduces disruptive conduct through moral and participatory learning approaches. It also agrees with Nseabasi and Akpan (2025), who found a significant relationship between school values such as self-discipline and reduced abusive tendencies among students, indicating that strong value orientation discourages verbal abuse. Similarly, Lau, Aipipidely and Ratu (2021) highlighted the harmful effects of verbal abuse, including intimidation, shame, and withdrawal, supporting the need for preventive value-based education. However, Simon, Uwaoma and Iwuala (2024) found no significant predictive effect of verbal abuse-related variables on emotional intelligence, differing from the present study, which emphasizes value education as a preventive strategy. The finding suggests that respect-oriented value education is a practical approach for reducing verbal abuse in Colleges of Education

Conclusions

The study concluded that students are of the perception that there is a positive perception among students regarding the impact of respect-oriented value education content on the reduction of verbal abuse among students in Colleges of Education in Kaduna State. Also, students perceived that respect-oriented value education as an effective strategy for minimizing verbal abuse and promoting respectful interpersonal interactions.

Recommendations

Based on the findings of the study, the following recommendations are put forward:

1. Colleges of Education should strengthen the integration of respect-oriented value education content into the curriculum and classroom activities to promote values such as respect, tolerance, empathy, and positive interpersonal relationships, thereby reducing the incidence of verbal abuse among students.
2. College administrators and lecturers should regularly organize value-based seminars, workshops, and counselling programs that emphasize respectful communication, conflict resolution, and responsible behavior to foster a culture of mutual respect and peaceful coexistence among students.

Contribution to Knowledge

The study established that:

1. Students perceived respect-oriented value education content as an effective strategy for reducing verbal abuse. They also believe that lessons emphasizing respect, courtesy, tolerance, and positive interpersonal relationships contribute substantially to minimizing the occurrence of verbal abuse within the college environment.

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Effects of Contextualized Learning Strategy on Performance in... Abubakar, S. R. (2026)

Effects of Contextualized Learning Strategy on Performance in Literature Text Contents among Secondary School Students in Kaduna-North, Kaduna State, Nigeria

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Abstract

*The study focuses on the effects of contextualized learning strategy on students' academic performance in Efua Sutherland's *The Marriage of Anansewa* in Senior Secondary School II, Kaduna-North, Nigeria. This study is grounded in Vygotsky's Sociocultural Theory of Learning, which highlights the role of culture, context and social interactions. Vygotsky's Sociocultural Theory of Learning was employed to portray Ghanaian socio-cultural authenticities and realities in the study of *The Marriage of Anansewa* in which contextualized learning strategy. The study employed quasi-experimental design pre-test, post-test control group that was non-equivalent and non-randomized. The population of the study was made up of 1,891 students and selected 114 through a purposive sample technique that consisted of 50 experimental group, 44 control group. The Contextualized Learning Achievement Test (CLAT) was used as the research instrument, which was validated by second-language experts, with Reliability established using Cronbach's alpha. The study revealed significant effects of the Contextualization learning strategy on Senior Secondary School Students' performance in understanding historical contextualization, appreciating cultural contextualization, and interpreting the social contextualization of the drama text, *The Marriage of Anansewa*. Therefore, the study recommended that contextualized learning strategy should be used to teach aspects of literature, emphasize cultural awareness, provide comprehensive professional development programs, and establish innovative assessment frameworks that enhance teaching and learning of African literature across all levels.*

Keywords: Contextualization Learning Strategy, Historical Cultural Contextualization, and Social Contextualization

Introduction

The teaching of Literature-in-English among secondary school students in Nigeria has persistently faced numerous pedagogical challenges that affect students' performance and learning engagement. Today, pedagogical research in teaching aspects of Literature-in-English highlights that contextual teaching and learning strategy is a promising second language teaching strategy, which is based on culturally-anchored approach to improve meaningful second language learning performance (Owusu & Mensah, 2026). The application of a contextualized learning strategy in *The Marriage of Anansewa* is pedagogically important, since African literature is deeply rooted in indigenous culture, norms, oral traditions, and socio-cultural practices. The contextualized learning strategy enables students to connect themes, characters and characterizations, and symbols to their existing experiences, thereby improving comprehension, learners' engagement and retention. Recent studies highlight that culture-responsive pedagogy and localized learning approaches improve learning outcomes by connecting abstract and familiar contexts to indigenous knowledge systems (Akinsola, 2025). In African classroom settings, such contextualized learning strategy also counters the sidelining of indigenous literature and foster identity declaration. Empirically, earlier studies have generally supported quasi-experimental and mixed-methods designs to compare contextualized learning strategy with conventional learning strategy. The findings consistently showed significant improvements in students' success, critical thinking skills, and participation when contextualized learning elements are integrated into instruction (Akinsola, 2025; Stoffelsma et al., 2025). However, these studies are regularly comprehensive across subjects or focus mainly on language education and sciences, with limited attention to explicit literary texts in Africa. The novelty of these findings' centres on a canonical African drama within a secondary school context in Kaduna-North, Nigeria. It reports the identified gap where contextualized learning strategy is rarely applied analytically in literature classrooms, notwithstanding increasing scholarly calls for traditionally grounded and context-based learning (Ajaps & ForhMbah, 2025). Thus, this study significantly contributes by offering insights into how contextualized learning strategy enhances literary appreciation for academic performance across West Africa.

In this regard, this approach aims to link the subject matter of literary work of art to second language learners' prior experiences, local cultures and community background knowledge so that they can perceive relevance and enthusiastically



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construct meaning from the text rather than memorization of the decontextualized facts of the text. Oladejo, Olateju, Aabove & Suwadu (2024); and Onowugbeda, Agbanimu, Okebukola, Ibukunolu, Tokunbo & Olori (2023) opined that context-grounded teaching is significant to reducing learners' anxiety, improving their conceptual understanding of the text, and increasing their learning performance and achievement.

"The Marriage of Anansewa" is a famous Ghanaian West African drama text that richly incorporates oral tradition, comedy, songs, and cultural mockery. The playwright has used dramaturgy, which includes the use of songs, communal chorus, proverbs and humour to foreground African indigenous cultural frameworks that depict canonical Ghanaian historical background and socio-cultural contexts in a performance-based learning situation. Thus, the textual and pedagogical analyses of *The Marriage of Anansewa* centred on a literary oral-performative work of art which culturally surrounded with humour, comedy and cultural satire that leveraged to improve students' text comprehension, critical thinking and interpretive skill about the text. However, the socio-cultural and folkloric features of the drama text are presented in an abstract and decontextualised process, which caused students to misunderstand the aesthetic and social meanings of the text (Anane et al., 2024). In teaching literary works of art, especially in African contexts, a contextualised instructional strategy is needed. Teaching Literature-in-English at senior secondary level in Kaduna-South typically enrolls diverse learners who are linguistically and culturally different, whose linguistic prior knowledge, storytelling practices, and reading performance vary significantly. This contextualised pedagogical strategy has integrated the use of performance, role-play, and songs linked to the text (*The Marriage of Anansewa*) to strengthen second-language learners' understanding of the plot, character and characterization, themes, and dramatic technique. Therefore, this study would provide second language teachers, researchers, curriculum designers, and language policy makers with rational empirical evidence aligned with Literature-in-English pedagogy on the effect of contextualized learning strategy in understanding historical contextualization, appreciating cultural contextualization, and interpreting social contextualization of the text, *The Marriage of Anansewa*, in order to improve Senior Secondary Students' performances.

Statement of the Problem

Many senior secondary school students in northern Nigeria do not have adequate background knowledge of Ghanaian precolonial and colonial era. This will limit students' ability to appreciate the text and to connect the events portrayed in the story to broader, relevant historical realities. Similarly, senior secondary school students in northern Nigeria have misunderstood the differences between Nigerian and Ghanaian historical, cultural and social norms. In the same way, second-language teachers often struggle to select and use effective teaching strategies and techniques for teaching literature in English. This occurs as a result of inadequate professional development training that is culturally and linguistically designed to prepare them beyond conventional classroom teaching. In Senior Secondary Schools in Kaduna State, there are serious issues of overpopulated classrooms taking Literature-in English as a subject, limited teaching and learning resources, unqualified second-language teachers teaching Literature-in English, and poor conditions of service, which hinder the effective implementation of teaching and learning within the state. It is evident that there is limited research in this area that measures the effect of a contextualized learning strategy on students' historical, cultural, and social understanding and cultural exposure related to literary texts. Sometimes in language curriculum, there is poor provision of rigid syllabi that minimize activities which are culturally responsive teaching and performance-oriented in the study of the prescribed literary textbooks for examination conducted by the West African Examination Council (WAEC) and the National Examination Council (NECO), which neglects oversimplifying linguistic and cultural references to the text.

Objectives of the Study

1. To investigate the effect of contextualized learning strategy on Senior Secondary Students' II performances in understanding the historical contextualization of the text, *The Marriage of Anansewa*.
2. To examine the effect of contextualized learning strategy on Senior Secondary Students' II performances in appreciating cultural contextualization of the text, *The Marriage of Anansewa*.
3. To assess the effect of contextualized learning strategy on Senior Secondary Students' II performances in interpreting social contextualization of the text, *The Marriage of Anansewa*.

Research Questions



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1. What is the effect of contextualized learning strategy on Senior Secondary Students' II performances in understanding historical contextualization of the text, *The Marriage of Anansewa*?
2. What is the effect of contextualized learning strategy on Senior Secondary Students' II performances in appreciating cultural contextualization of the text, *The Marriage of Anansewa*?
3. What is the effect of contextualized learning strategy on Senior Secondary Students' II performances in interpreting social contextualization of the text, *The Marriage of Anansewa*?

Research Hypotheses

1. There is no significant effect of contextualized learning strategy on Senior Secondary Students' II performances in understanding historical contextualization of the text, *The Marriage of Anansewa*.
2. There is no significant effect of contextualized learning strategy on Senior Secondary Students' II performances in appreciating cultural contextualization of the text, *The Marriage of Anansewa*.
3. There is no significant effect of contextualized learning strategy on Senior Secondary Students' II performance in interpreting social contextualization of the text, *The Marriage of Anansewa*.

Literature Review

A contextualized learning strategy connects second-language learners' background knowledge and sociocultural practices to literary texts in order to strengthen text comprehension, reading engagement and interpretation. This supported the view that second language learners' background knowledge is the most effective and reliable instrument for enhancing their inferential comprehension (Carter et al., 2024). For Gillam et al. (2024) and Quilaqueo & Torres (2024), contextualization is operated through three mechanisms, which include activation and improvement of second language learners' background knowledge; anchoring vocabulary learning and language performance practices; and providing second language learners with opportunities to enact, adapt, and analyze literary texts by making implicit socio-cultural and socio-historical meanings clear. For that, these mechanisms are explicitly relevant to teaching drama texts such as *The Marriage of Anansewa*, which heavily depends on cultural performance and historical orientations presented in the form of social satire. Gillam et al. (2024) opined that contextualized learning strategy is an integrated instruction that explicitly shows strong improvements in second language learners' abilities in text comprehension, text analysis and text interpretation by linking their historical struggles and social causes to the literary texts. For Gabriel & López (2024), cultural contextualization related to *The Marriage of Anansewa* blends Ghanaian traditional African culture that creates an engaging experience by bringing Ghanaian traditional Akan socio-cultural life and activities presented in a realm of African traditional oral storytelling. This claims that teaching second language learners literary and linguistic resources used in the text raises their motivation to meaningfully engage with the canonical Ghanaian traditional African cultures. For *The Marriage of Anansewa*, second language classroom understands the Akan culture, community rituals, staging, songs, proverb structures and bride-price for students to retrieve and interpret cultural cues. Therefore, contextualized learning strategy has co-constructed historical, cultural and social content in order to expand second language learners' ability to read literary texts as culturally established artefacts rather than decontextualize the work of art (Quilaqueo & Torres, 2024). For Johnson, Vlach, & Leija (2024), interpreting social contextualization in relation to "*The Marriage of Anansewa*" is viewed in the form of satirical work of art and social-analytic, irony, humour and staging critique of communal arrangements associated with greediness, patriarchy, and social status. This used a diverse and performative work of art, especially the play, to portray socio-cultural representation and translate social critique in a more reliable manner rather than passive reading alone (Johnson et al., 2024). In this regard, enactive pedagogy through a contextualized learning strategy encourages second-language learners to reconstruct an active habit of text analysis that will improve their critical-thinking ability to interpret socio-cultural contexts and formulate critical content analysis of traditional African cultures embedded in literary works of art. Therefore, contextualized learning strategy showed that interpreting social contextualization enhances learning transfer from text comprehension to socio-cultural interpretation (Quilaqueo & Torres, 2024).

Empirical studies

The Marriage of Anansewa is related to African dramatic texts that have largely focused on thematic, socio-cultural, and ideological dimensions, which employed predominantly text-based approaches for empirical scholarship. For instance, Anane et al. (2014) examined the role of humour in Ghanaian plays using a narrative research design and purposive sampling, revealing that humour served as a sophisticated device for audience engagement, helping sustain the playwright's



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interest throughout the theatrical performance. Similarly, Annin and Adoma (2015) relatively analysed Ghanaian socio-cultural traditions in *The Marriage of Anansewa* and *The Fifth Landing Stage* by concluding that foreign socio-cultural influences significantly form indigenous practices, custom and identities in West Africa. Further extending the discourse, Asen (2017) examined the depiction of the bride price in *The Marriage of Anansewa* and *Wedlock of the Gods*, highlighting its commercialization and its consequences for gender discrimination and domestic violence in West Africa. The study highlighted feminist apprehensions and advocated for institutional involvement to curb exploitative practices within Ghanaian socio-cultural traditions. In a related socio-cultural-critical inquiry, Aguessy, Chabi, and Ayedon (2019) applied cultural studies to criticism to investigate deception and its socio-economic triggers, classifying poverty, disproportionate ambition, and imitation as key factors of dishonest behaviour in the play. Recently, Boateng and Ben-Daniels (2025) employed a Marxist literary framework to question the motivations of the trickster figure Ananse, arguing that capitalist ideology adopts insatiable, materially obsessed deception. The findings suggested that Efua Sutherland employed the Anansegoro theatrical tradition to mock capitalist excesses and distinctive tendencies in the play. Despite the valuable contributions, studies are largely inadequate in thematic interpretation, ideological analysis, and cultural critique, with nominal consideration of linguistic and pedagogical scopes, particularly relative to classroom claims and language instruction. None of the reviewed studies clearly examines how discourse structures, stylistic basics, or instructional approaches will develop learners' comprehension and engagement with the play. Therefore, the present study attempts to bridge the gap between integrated literary analysis and pedagogical implications by explicitly examining how the drama text can be employed within English education frameworks. This study suggests that an additional perspective of literary criticism is cooperated with applied linguistics and classroom pedagogy, which significantly contributes to improving the Contextualized Learning strategy and impacts on learners' comprehension.

Theoretical Framework

The study is based on Vygotsky's Sociocultural Theory of Learning (1978), which highlights the role of culture, context, and social interaction in shaping second-language learners' cognitive development (Daniels, 2023). Vygotsky's Sociocultural Theory of Learning is relevant to the study of "*The Marriage of Anansewa*", in which a contextualized learning strategy was employed to guide Senior Secondary II students in the interpretation of the play not only as a text but as a portrayal of Ghanaian socio-cultural authenticities and realities (Aguessy, Sidi-habi, & Ayedon, 2024). The theory buttressed the point that cultural literary text enhances second language learners' critical thinking skills in text interpretation for collective meaning-making (John-Steiner & Mahn, 2024). Vygotsky's Sociocultural Theory of Learning, it relevant to education studies. It emphasized that social interaction, cultural influences, and contextual experiences in knowledge construction. The research on Contextualized Learning strategy pointed out that students achieve and develop better comprehension, text interpretation when a literary text is connected to the their cultural and social realities. The studies also showed that collaborative learning, classroom discussion, and supported language strategies enhance learners' problem-solving skills, critical thinking skills, and learning performances. Therefore, Vygotsky's sociocultural theory has played a significant role in providing a robust research framework that helps students in text analysis and using contextualized learning instruction to improve their language performance in understanding historical, cultural, and social dimensions of the literary texts (Quilaqueo & Torres, 2024).

Research Methodology

Research Design

The study used a quasi-experimental pre-test, post-test control group of non-equivalent and non-randomized design. The population of the study consisted of 1,891 Senior Secondary II Students in Kaduna-North. The study selected 99 students through a purposive sample technique. For the purposes of this study, 44 students were in the control group, while 50 were in the experimental group, enabling a meaningful comparison. The Contextualized Learning Achievement Test (CLAT) was developed by the researchers as a structured, multiple-choice instrument to assess students' performance in understanding the historical, cultural, and social contexts of the play. The correlation between the two sets of scores was computed using Pearson's correlation coefficient, yielding a value of 0.85, indicating high reliability. To further assess internal consistency, Cronbach's Alpha was calculated, yielding a value of 0.82, confirming that the instrument consistently measures the intended constructs of reading comprehension and fluency across multiple test instances. Contextualized Learning Strategy on Students' Academic Performance: the experimental group was carried out over 6 weeks and consisted of 12 lessons (i.e., two lessons per week). Each class lasted about 40–50 minutes, aligned with the standard secondary



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school timetable in Kaduna State. The Contextualized Learning approach employed in the experimental class emphasizes understanding historical contextualization, appreciating cultural contextualization and interpreting social contextualization of the text, *The Marriage of Anansewa*. The structured sequence learning process followed whereby Introduction and Activation of Prior Knowledge was carried out for Weeks 1–2 through questioning, brainstorming, and short discussions; Guided Inquiry and Exploration was carried out for Weeks 2–4 to engaged in helping students reading activities to Identify main ideas, supporting details, interpretation of meanings of words using context clues, analyze characters, themes, textual features and making predictions and inferences. The Concept Development and Graphic Organization was carried out for Weeks 3–5 through activities that help students connect ideas, visualize relationships, and categorize information within the play. The Collaborative Learning and Discussion was carried out for Weeks 4–6 through the activities that encouraged articulation of ideas, deeper comprehension, and clarification of misunderstandings through social interaction. The Evaluation and feedback were carried out immediately to guide learning and expand comprehension skills through class exercises, oral questioning and short quizzes.

Data Analysis

Descriptive statistics were used to answer the research questions, while an independent sample t-test was used to test and analyze the hypotheses. The use of the ANCOVA in this study was appropriate; specifically, the scores confirmed between the experimental and control groups were consistent as indicated ($p > 0.05$). The conditions explained the use of the ANCOVA for comparing group means and should be measured to ensure the validity of the results.

Presentation of Results

This presented results and discussions of the major findings in answering the research questions using descriptive statistics (mean, standard deviation) and testing the hypotheses using inferential statistics (ANCOVA) at $p\text{-value} \leq 0.05$. Therefore, the mean scores of the experimental and the control groups were used to determine the performances of Senior Secondary II Students in understanding historical contextualization, appreciating cultural contextualization, and interpreting social contextualization of the drama text, *The Marriage of Anansewa*.

Answering Research Questions

This presented the answering of research questions one to three using descriptive statistics (mean, standard deviation).

Research Question 1:

What is the effect of contextualized learning strategy on Senior Secondary Students' II performances in understanding the historical contextualization of the text, *The Marriage of Anansewa*? To determine the effect of contextualized learning strategy in understanding historical contextualization of the text, the Contextualized Learning Achievement Test (CLAT) was administered and the results were presented in Table 1.

Table 1: CLAT in Understanding Historical Contextualization of the Text

Group	Test	N	Mean ($\bar{X}$)	Standard Deviation (SD)
Experimental	Pretest	50	42.72	11.82
Experimental	Posttest	50	65.1	14.6
Control	Pretest	44	46.59	10.74
Control	Posttest	44	44	9.42

Table 1 presents the pretest and posttest performance of experimental and control groups in historical contextualization of *The Marriage of Anansewa*. The experimental group ($N=50$) had a pretest mean of 42.72 ($SD=11.82$), which improved markedly to a posttest mean of 65.1 ($SD=14.6$), indicating substantial gain after exposure to the instructional treatment. In contrast, the control group ($N=44$) recorded a pretest mean of 46.59 ($SD=10.74$) and a slightly reduced posttest mean of 44 ($SD=9.42$), showing no improvement. This suggests that the instructional strategy positively influenced the experimental group's performance, while the control group showed minimal change over time.

Research Question 2:

What is the effect of contextualized learning strategy on Senior Secondary Students' II performances in appreciating cultural contextualization of the text, *The Marriage of Anansewa*? To determine the effect of contextualized learning strategy in appreciating cultural contextualization of the text, the Contextualized Learning Achievement Test (CLAT) was administered and the results were presented in Table 2.

Table 2: CLAT in Appreciating Cultural Contextualization of the Text



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Group	Test	N	Mean ($\bar{X}$)	Standard Deviation (SD)
Experimental	Pretest	50	43.93	10.37
Experimental	Posttest	50	50.16	13.08
Control	Pretest	44	45.42	12.94
Control	Posttest	44	50.84	14.95

Table 2 presents the pretest and posttest scores of experimental and control groups in appreciating cultural contextualization of *The Marriage of Anansewa*. The experimental group (N=50) recorded a pretest mean of 43.93 (SD=10.37), which increased to a posttest mean of 50.16 (SD=13.08), indicating improvement after the intervention. Similarly, the control group (N=44) had a pretest mean of 45.42 (SD=12.94) and a posttest mean of 50.84 (SD=14.95), showing a slight improvement. However, the control group's gain was marginally higher than that of the experimental group, suggesting that while both groups improved, the treatment effect was not strongly differentiated in this aspect.

Research Question 3:

What is the effect of contextualized learning strategy on Senior Secondary Students' II performances in interpreting social contextualization of the text, *The Marriage of Anansewa*? To determine the effect of contextualized learning strategy in interpreting social contextualization of the text, the Contextualized Learning Achievement Test (CLAT) was administered and the results were presented in Table 3.

Table 3: CLAT in Interpreting Social Contextualization of the Text

Group	Test	N	Mean ($\bar{X}$)	Standard Deviation (SD)
Experimental	Pretest	50	44.75	11.55
Experimental	Posttest	50	50.97	14.91
Control	Pretest	44	44.15	11.39
Control	Posttest	44	49.5	11.7

Table 3 presents the pretest and posttest scores of experimental and control groups on interpreting social contextualization of *The Marriage of Anansewa*. The experimental group (N=50) had a pretest mean of 44.75 (SD=11.55), which increased to a posttest mean of 50.97 (SD=14.91), indicating improvement after the intervention. Similarly, the control group (N=44) recorded a pretest mean of 44.15 (SD=11.39) and a posttest mean of 49.50 (SD=11.70), also showing improvement. However, the gain in the experimental group is slightly higher than that of the control group, suggesting a modest advantage of the instructional strategy in enhancing students' performance in social contextual interpretation.

Testing Research Hypotheses

The study hypotheses were formulated to measure the significant effect of the study variables on the effect of contextualized learning strategy on Senior Secondary Students' II performances in understanding historical contextualization, appreciating cultural contextualization, and interpreting social contextualization of the drama text, *The Marriage of Anansewa*. Therefore, the three (3) formulated Null Hypotheses were tested using ANCOVA. These are as follows:

Null Hypotheses 1:

There is no significant effect of contextualized learning strategy on Senior Secondary Students' II performances in understanding the historical contextualization of the text, *The Marriage of Anansewa*. The ANCOVA was used to test the hypothesis at p-value ≤ 0.05 .

Table 4: CLAT in Understanding Historical Contextualization of the Text

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	3441.451	2	1720.73	10.99	0
Intercept	14852.495	1	14852.49	94.86	0
Pretest Achievement	14.834	1	14.83	0.1	0.759
Group (EXP. & Control)	3252.799	1	3252.8	20.78	0
Error	14247.666	91	156.57	—	—
Total	256807	94	—	—	—
Corrected Total	17689.117	93	—	—	—



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Table 4 presents the ANCOVA results on students' posttest scores in understanding historical contextualization of *The Marriage of Anansewa*. The results show that the corrected model was statistically significant, $F(2, 91) = 10.99, p < .001$, indicating that the model explained a meaningful portion of the variance in students' performance. The pretest achievement was not a significant covariate, $F(1, 91) = 0.10, p = .759$, suggesting that initial differences did not influence posttest outcomes. However, the group effect was significant, $F(1, 91) = 20.78, p < .001$, indicating a significant difference between the experimental and control groups. This implies that the instructional treatment had a significant effect on students' performance in historical contextualization.

Null Hypothesis 2:

There is no significant effect of the contextualized learning strategy on Senior Secondary Students' II performances in appreciating the cultural contextualization of the text, *The Marriage of Anansewa*. The ANCOVA Analysis of Posttest Scores was used to test the hypothesis at $p\text{-value} \leq 0.05$.

Table 5: CLAT in Appreciating Cultural Contextualization of the Text

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	3440.93	2	1720.465	10.99	0
Intercept	24475.304	1	24475.3	156.32	0
Posttest	14.313	1	14.313	0.09	0.763
Group (EXP. & Control)	3430.419	1	3430.419	21.91	0
Error	14248.187	91	156.573	—	—
Total	256807	94	—	—	—
Corrected Total	17689.117	93	—	—	—

Table 5 presents the ANCOVA results on students' posttest scores in appreciating cultural contextualization of *The Marriage of Anansewa* after controlling for gender. The corrected model was statistically significant, $F(2, 91) = 10.99, p < .001$, indicating that the model adequately explained variation in students' performance. However, the experimental and control groups were not a significant covariate, $F(1, 91) = 0.09, p = .763$, suggesting that the experimental and control groups students performed similarly. In contrast, the group effect was statistically significant, $F(1, 91) = 21.91, p < .001$, indicating a significant difference between the experimental and control groups. This shows that the instructional strategy had a significant effect on students' cultural contextualization performance irrespective of the experimental and control groups.

Null Hypothesis 3:

There is no significant effect of contextualized learning strategy on Senior Secondary Students' II performances in interpreting social contextualization of the text, *The Marriage of Anansewa*. The ANCOVA Analysis of Posttest Scores was used to test the hypothesis at $p\text{-value} \leq 0.05$.

Table 6: CLAT in Interpreting Social Contextualization of the Text

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	3470.329	2	1735.165	11.11	0
Intercept	28107.646	1	28107.65	179.88	0
School Type	43.712	1	43.712	0.28	0.598
Group (EXP. & Control)	3423.646	1	3423.646	21.91	0
Error	14218.788	91	156.25	—	—
Total	256807	94	—	—	—
Corrected Total	17689.117	93	—	—	—

Table 6 presents the ANCOVA results on students' posttest scores in interpreting social contextualization of *The Marriage of Anansewa* after controlling for school type. The corrected model was statistically significant, $F(2, 91) = 11.11, p < .001$, indicating that the model adequately explained variation in students' performance. However, school type was not a significant covariate, $F(1, 91) = 0.28, p = .598$, suggesting that students from different school types performed similarly. In contrast, the group effect was statistically significant, $F(1, 91) = 21.91, p < .001$, indicating a significant difference



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between the experimental and control groups. This implies that the contextualized learning strategy significantly improved students' social contextualization performance regardless of school type.

Discussion of Findings

The study's findings statistically demonstrated the significant effect of a contextualized learning strategy on improving Senior Secondary Students' II performance across historical, cultural, and social contextualizations in understanding the text, *The Marriage of Anansewa*, by establishing significant rejection of all three Null Hypotheses. The effect of contextualized learning strategy is significantly supported by Lev Vygotsky's socio-cultural theory, which highlights that contextualized learning strategy occurs through social interaction with cultural tools. The contextualized learning strategy aligns with Vygotsky's concept of the Zone of Proximal Development (ZPD), in which students achieve advanced levels of understanding through collaboration, guided support, and the use of familiar cultural references (Gillam, Ukrainetz, & Reutzell, 2024). Teachers support students' learning more successfully by making it complicated to literary concepts, whereby integrating culturally meaningful frameworks into the contextualized learning strategy. Thus, contextualized learning strategy not only progresses academic performance but also situates learning approach within socially and culturally meaningful and responsive framework for strengthening relevance in West African literature pedagogy.

The findings of the study confirmed that there was an improvement in students' historical understanding of the text, which aligned with a recent investigation conducted by Gillam, Gillam, Magimairaj, Capin, Israelsen-Augenstein, Roberts, & Vaughn, (2024) in which contextualized learning strategy was revealed as an embedded language instruction into the naturally occurring teaching activities, which serve as the literary context for both language learning and language practices in relevant activities. This established an explicit operational description of contextualized language instruction, providing empirical evidence of literary and linguistic connections, particularly regarding the complex historical narratives in African literary works of art. The significant effect observed in this study can be better understood within the unique pedagogical context of African literature, where meaning is often rooted in cultural symbolism, oral traditions, communal values, and familiar social realities. Contextualized learning likely enhanced students' performance by bridging the gap between the text and their lived experiences. In *The Marriage of Anansewa*, for instance, themes such as marriage negotiations, family expectations, and trickster dynamics resonate strongly with indigenous African worldviews. When instruction connects these elements to students' socio-cultural backgrounds, it reduces abstraction, deepens interpretation, and promotes active engagement. This explains the observed gains in comprehension, critical thinking, and retention, as learners are not merely decoding text but co-constructing meaning from culturally relevant perspectives (Akinsola, 2025). Hamidah and Maqi (2024) concurred that contextualized learning strategy requires some critical implementation considerations and theoretical foundation that emphasizes the relevant connection to teaching literary content to real-life experiences. This has established theoretical foundations that limit the investigation of socio-cultural specificity in contextualized learning, especially within African literary traditions. Therefore, the present study established significant improvement in senior secondary school students' performance in understanding the historical contextualization of African drama texts taught using contextualized learning strategy. The findings of the study concurred with Eticha, Brunninge, & Tessema (2024), who studied the pronounced significant effect that was observed in cultural contextualization, which resonated with the present study that teaching African drama text has demonstrated skyrocketing recognition of socio-cultural authenticity in literary education tradition. The study also provided that the pedagogical framework has significantly integrated African socio-cultural perspectives into Literature-in-English curricula. However, Howard (2003) argued that cultural contextualization strategy is criticized for theoretical implementation challenges in standardized language educational systems where socio-cultural sensitivity conflicted with standardized and innovative assessment requirements. Kilag et al. (2023) provided contemporary scholarship with methodological insights into the effective use of graphic organizers, interactive multimedia, and visual instructional materials to significantly develop second language learners' ability to interpret and analyze literary works of art, especially poetry. This suggested that contextualized learning strategy had significant benefits in providing concrete pedagogical frameworks that address inherent socio-cultural problems presented in *The Marriage of Anansewa*. Nguyen et al. (2022) and Wang & Lee (2023) observed that literary texts have enhanced the performance of second-language learners through context-based approaches. This provided empirical evidence for personalized reading of literary texts through technological innovations to address collective scopes relevant to understanding the socio-cultural contexts presented in African literature (Ajaps & ForhMbah, 2025). The study showed that contextualization is effective by integrating literary



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texts with technology, focusing on literary reading lessons and exercises in contexts relevant to learners' interests and backgrounds (Okonkwo, 2021; Mohammed & Musa, 2023; and Zhang, 2022) agreed that the student-centered learning strategy is applicable to contextualized settings across diverse socio-cultural contexts, with reasonable consideration of Africa within literary traditions. The present study's focus on the effect of contextualized learning demonstrated the strategy's implementation through cultural authenticity. It also demonstrated that an effective contextualized learning strategy requires a meticulous sense of balance between innovative pedagogy and cultural sensitivity (Gay, 2022). Despite the fact that contextual learning strategy showed promising need for constant professional development, an appropriate language assessment strategy, and careful consideration to cultural authenticity presented in the text. This proved that the findings of the study encouraged text interpretation in a broader sense for cultural sensitivity (Banks, 2022). The study emphasized a culturally explicit pedagogical framework that integrated technological innovations within traditional cultural practices (Zhou & Li, 2023). The findings contributed to this development by establishing empirical evidence for the effect of contextualized learning strategy in teaching Literature-in-English for continued implementation and long-term impact assessment (Okonkwo, 2021). This study has limitations that should be acknowledged. First, the study showed that within a restricted geographical area, which limits the generalizability of the results to other study contexts. Second, the period of the intervention (six weeks) will not be enough to determine the long-term effects of Contextualized Learning strategy. Third, the research should mainly rely on the Contextualized Learning Achievement Test (CLAT), which will not capture all scopes of learning outcomes. Moreover, extraneous variables, students' background knowledge and teacher-related aspects were not fully measured. Therefore, the limitations offer avenues for further study and improvement of Contextualized Learning strategy.

Conclusion

This study successfully rejected all the research null hypotheses by demonstrating a statistically significant improvement in Senior Secondary Students' II performance in understanding the historical, cultural, and social contextualization of drama texts. The study demonstrated that the experimental group achieved significantly better performance than the control group in understanding historical contextualization. This finding confirmed that contextualized learning strategy significantly allowed senior secondary students to connect their prior knowledge of literary narratives with historical contexts. The study indicated that cultural contextualization had pronounced significant improvement that occurred in cultural contextualization of the text appreciation, where the experimental group had significantly outperformed the control group. This demonstrated that contextualized learning strategy is predominantly effective in improving senior secondary students' understanding and deepening their cultural understanding and appreciation of socio-cultural symbols and traditional practices portrayed in African literary texts. The study also observed that the social contextualization interpretation of the text, the experimental group had exceeded the control group significantly. This suggested that contextualized learning strategy profoundly affected senior secondary students' ability to understand socio-cultural dynamics, social relationships and interpersonal interactions presented in the work of art.

Recommendations

1. Educational stakeholders and language policy frameworks should highlight the significance of cultural sensitivity through guidelines on implementing contextualized learning strategy.
2. There should be adequate resources for developing contextualized learning materials which enhance second language learners' understanding of historical, cultural, and social contexts.
3. There is need for professional development programs that prepare second language teachers to implement contextualized learning strategy effectively in teaching language and Literature-in-English.
4. There is need to establish conducive learning environments that support the implementation of contextualized learning strategy effectively in teaching language and Literature-in-English with effective technology integration.
5. Second language teachers' support systems should be established to assist them in implementing contextualized learning strategy in teaching language and Literature-in-English.
6. Second language teachers teaching Literature-in-English should invest in teaching and learning African literature, history, and socio-cultural contexts to enhance effective, contextualized instruction.



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Perception of Artificial Intelligence Adoption in Accounting Education Programs among Colleges of Education Lecturers and Students in North Central, Nigeria

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Abstract

This study examines lecturers' and students' perception of artificial intelligence adoption in accounting education in Colleges of Education, North Central, Nigeria. The study adopted a descriptive survey research design. The population consists of 5,134 Accounting students in 16 Colleges of Education in North Central Nigeria. Sample size 357 was determined using Krejcie and Morgan (1970) table, which provided an appropriate representative sample from the population. Data were collected using a structured questionnaire titled: Adoption of AI Accounting Education Questionnaire (AAIAEQ). The instrument was validated by experts in the Department of Accounting, Ibrahim Badamasi Babangida University (IBBU), Lapai. The instrument was pilot tested using 40 Accounting students from Federal College of Education, Zuba. Reliability was determined using Cronbach Alpha, yielding a coefficient of 0.85, indicating high reliability. Mean and standard deviation were used to answer research questions, while t-test was used to test hypotheses at 0.05 level of significance. Based on the findings, the study concludes that lecturers and students in Colleges of Education in North Central Nigeria generally hold a positive perception toward the adoption of Artificial Intelligence (AI) in accounting education. The study established that AI is viewed as a valuable instructional tool capable of improving teaching effectiveness, simplifying complex Accounting concepts, enhancing students' understanding, and increasing academic performance and interest in accounting courses. The study recommends that Government and relevant educational authorities should increase funding for Colleges of Education to support the acquisition, installation, and maintenance of Artificial Intelligence tools and digital learning infrastructure required for effective Accounting instruction.

Keywords: Lecturers' and Students' Perception, Artificial Intelligence Adoption, Accounting Education.

Introduction

Artificial Intelligence (AI) has emerged as one of the most transformative technologies in education, reshaping how teaching and learning processes are conducted globally. AI-powered tools such as intelligent tutoring systems, automated grading systems, and adaptive learning platforms are increasingly being integrated into higher education to enhance instructional delivery (UNESCO, 2023; OECD, 2024). In recent years, educational institutions have begun to adopt AI to improve learning outcomes, particularly in skill-based disciplines such as Accounting. These technologies support personalized learning, real-time feedback, and improved student engagement, making learning more efficient and interactive (Zawacki-Richter et al., 2023). In Nigeria, the integration of AI in education is still at an emerging stage. However, increasing exposure to digital learning platforms and educational technologies has created awareness among students and educators regarding its potential benefits (National Universities Commission [NUC], 2024). Despite this, adoption remains limited due to infrastructural and institutional constraints. Accounting education, which requires accuracy, analytical thinking, and practical application, stands to benefit significantly from AI integration. AI tools can assist students in understanding complex accounting concepts, automating calculations, and improving decision-making skills (Adewale & Ibrahim, 2023). Furthermore, instructional delivery in accounting courses traditionally relies on lecturer-centered approaches. However, AI has introduced student-centered learning methods that allow for adaptive instruction and personalized academic support, thereby improving comprehension and performance (UNESCO, 2023). Despite these advantages, students' perception of AI adoption remains critical in determining its successful integration. Positive perception may enhance acceptance and usage, while negative perception may hinder implementation regardless of its benefits (OECD, 2024).



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This study examines lecturers' and students' perception of artificial intelligence adoption in accounting education in Colleges of Education, North Central Nigeria.

Statement of the Problem

Despite global advancement in educational technology, many Colleges of Education in Nigeria still rely heavily on traditional teaching methods. This has limited the integration of innovative tools such as Artificial Intelligence in instructional delivery, particularly in accounting education. Accounting students often face difficulties in understanding abstract concepts such as financial reporting, auditing, and taxation. These challenges are exacerbated by limited access to modern instructional technologies that could simplify learning processes (Adewale & Ibrahim, 2023). Although AI has demonstrated significant potential in enhancing teaching effectiveness, many institutions in Nigeria lack the infrastructure, trained personnel, and policy frameworks necessary for its effective adoption (NUC, 2024). This has created a gap between global educational practices and local realities. Lecturers and students' perception plays a major role in determining the success of any technological innovation in education. If lecturer and students perceive AI as complex, irrelevant, or inaccessible, its adoption may be resisted even if it is beneficial. Therefore, this study investigates Lecturers' and Students' Perception of Artificial Intelligence Adoption in Accounting Education in Colleges of Education, North Central Nigeria.

Objectives of the Study

1. To determine the perception of lecturers and students on the adoption of Artificial Intelligence in accounting education in Colleges of Education in North Central Nigeria.
2. To examine the perceived benefits of Artificial Intelligence in the teaching and learning of Accounting among lecturers and students in Colleges of Education in North Central Nigeria.
3. To identify the challenges affecting the adoption of Artificial Intelligence in Accounting education as perceived by lecturers and students in Colleges of Education in North Central Nigeria

Research Questions

1. What are the perceptions of lecturers and students on the adoption of Artificial Intelligence in accounting education in Colleges of Education in North Central Nigeria?
2. What are the perceived benefits of Artificial Intelligence in the teaching and learning of Accounting among lecturers and students in Colleges of Education in North Central Nigeria?
3. What challenges affect the adoption of Artificial Intelligence in accounting education as perceived by lecturers and students in Colleges of Education in North Central Nigeria?

Research Hypotheses

- H₀₁:** There is no significant difference between the mean responses of lecturers and students on the adoption of Artificial Intelligence in accounting education in Colleges of Education in North Central Nigeria
- H₀₂:** There is no significant difference between the mean responses of lecturers and students on the benefits of Artificial Intelligence in the teaching and learning of Accounting among lecturers and students in Colleges of Education in North Central Nigeria
- H₀₃:** There is no significant difference between the mean responses of lecturers and students on the challenges affect the adoption of Artificial Intelligence in accounting education as perceived by lecturers and students in Colleges of Education in North Central Nigeria

Literature Review

Concept of Artificial Intelligence

Artificial Intelligence (AI) refers to the capability of computer systems and machines to perform tasks that normally require human intelligence, such as learning, reasoning, problem-solving, decision-making, language understanding, and pattern recognition (Russell & Norvig, 2021). AI systems are designed to process large volumes of data, identify relationships, and generate intelligent responses with minimal human intervention. Recent advancements in machine learning, deep learning, natural language processing, and generative AI have significantly expanded the application of AI across various sectors, including education, healthcare, business, and finance (World Economic Forum, 2024). In the educational sector, AI involves the use of intelligent systems to support teaching, learning, assessment, and administrative functions. UNESCO (2023) defines AI in education as the deployment of computer-based systems that can adapt to learners' needs, provide personalized instruction, automate routine educational tasks, and support decision-making processes. AI-powered



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educational tools include intelligent tutoring systems, chatbots, virtual assistants, learning analytics platforms, automated grading systems, and adaptive learning software. The emergence of generative AI applications such as ChatGPT, Gemini, and Microsoft Copilot has further transformed educational practices by enabling students and educators to access instant information, generate educational content, receive feedback, and engage in interactive learning experiences (OpenAI, 2024). According to the OECD (2024), AI has the potential to improve educational quality by supporting personalized learning pathways, enhancing student engagement, and facilitating data-driven instructional decisions. In higher education, AI is increasingly being integrated into curriculum delivery to improve learning outcomes and develop students' digital competencies. The International Society for Technology in Education (ISTE, 2024) noted that AI technologies can support critical thinking, problem-solving, and collaborative learning while preparing learners for technology-driven workplaces. Consequently, AI is becoming an indispensable component of modern educational systems and instructional practices.

Concept of Accounting

Accounting is the systematic process of identifying, recording, classifying, summarizing, analyzing, interpreting, and communicating financial information to facilitate informed decision-making by individuals, organizations, and other stakeholders (International Accounting Standards Board [IASB], 2023). It serves as a critical tool for measuring financial performance, ensuring accountability, and supporting business planning and control. Accounting is often described as the language of business because it provides relevant financial information needed by managers, investors, creditors, governments, and other stakeholders to make economic decisions (Atrill & McLaney, 2023). The discipline encompasses various branches, including financial accounting, management accounting, auditing, taxation, and forensic accounting. In educational institutions, Accounting is a core component of business education and is designed to equip students with the knowledge and skills necessary for financial management, reporting, and analysis. According to the International Federation of Accountants (IFAC, 2024), modern accounting education emphasizes the integration of technological competencies, data analytics, and digital tools to prepare graduates for the evolving demands of the accounting profession. The rapid advancement of digital technologies, including AI, has transformed accounting practices globally. As a result, accounting education is increasingly incorporating technology-driven learning approaches to ensure that graduates possess the competencies required in contemporary workplaces (Association of Chartered Certified Accountants [ACCA], 2024). This development underscores the importance of integrating innovative technologies into accounting instruction.

Concept of Accounting Education

Accounting education refers to the structured process of teaching and learning accounting knowledge, principles, skills, and professional competencies within formal educational institutions. It involves the training of learners in areas such as financial accounting, cost and management accounting, auditing, taxation, and financial reporting with the aim of preparing them for professional practice and decision-making roles in business and public sectors (IFAC, 2024; ACCA, 2024). Accounting education is designed not only to impart technical knowledge but also to develop analytical thinking, ethical reasoning, problem-solving abilities, and ICT competencies required in modern accounting practice. According to the International Accounting Education Standards Board (IAESB, 2023), effective accounting education should integrate both theoretical foundations and practical applications to ensure that graduates are competent and workplace-ready. In contemporary education systems, accounting education is increasingly influenced by technological advancement and digital transformation. The integration of digital tools, simulation software, and Artificial Intelligence has reshaped how accounting is taught and learned, shifting emphasis from rote memorization to experiential and technology-driven learning approaches (OECD, 2024).

Impact of AI in Teaching and Learning of Accounting Education

Artificial Intelligence has significantly influenced the instructional delivery of Accounting by enhancing teaching effectiveness, improving learning outcomes, and supporting the acquisition of professional competencies. AI-powered technologies enable lecturers to automate routine tasks such as grading assignments, generating assessments, and tracking students' progress, thereby allowing them to devote more time to instructional activities and student support (UNESCO, 2023). One of the major impacts of AI in accounting education is its ability to provide personalized learning experiences. AI systems can analyze learners' performance, identify strengths and weaknesses, and recommend customized learning materials that address individual needs (OECD, 2024). This adaptive learning approach enhances students' understanding of accounting concepts and improves academic achievement. AI also improves the accuracy and efficiency of financial calculations, data analysis, and reporting exercises commonly encountered in accounting courses. Through intelligent



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software applications, students can gain practical experience in handling accounting data, preparing financial statements, and conducting financial analyses with reduced errors (IFAC, 2024). This helps bridge the gap between classroom learning and professional accounting practice. Furthermore, AI promotes active learning by providing real-time feedback and interactive learning environments. Zawacki-Richter et al. (2023) observed that AI-supported learning systems enhance student engagement, motivation, and participation through instant responses and continuous assessment mechanisms. Similarly, OpenAI (2024) noted that generative AI tools can assist students in solving accounting problems, explaining complex concepts, and generating learning resources. Despite these benefits, concerns have been raised regarding the adoption of AI in accounting education. Issues such as inadequate infrastructure, limited digital literacy, ethical concerns, data privacy risks, and overreliance on technology may hinder effective implementation (World Bank, 2024). Nevertheless, the growing integration of AI into accounting practice and education suggests that AI will continue to play a significant role in shaping the future of Accounting instruction and learning.

Methodology

The study adopted a descriptive survey research design. The population consists of 5,134 Accounting students in 16 Colleges of Education in North Central Nigeria. Sample size 357 was determined using Krejcie and Morgan (1970) table, which provided an appropriate representative sample from the population. Data were collected using a structured questionnaire. titled: Adoption of AI Accounting Education Questionnaire (AAIAEQ): The instrument was validated by experts in the Department of Accounting, Ibrahim Badamasi Babangida University (IBBU), Lapai. The instrument was pilot tested using 40 Accounting students from Federal College of Education, Zuba. Reliability was determined using Cronbach Alpha, yielding a coefficient of 0.85, indicating high reliability. Mean and standard deviation were used to answer research questions, while t-test was used to test hypotheses at 0.05 level of significance.

Presentation of Results

Table 1: Categories of Respondents

S/No	Category of Respondents	Frequency	Percentage (%)
1	Lecturers	49	13.7
2	Students	308	86.3
	Total	357	100.0

Source: Field Survey, 2026.

Table 1 shows the distribution of respondents according to their categories. The results indicate that out of the 357 respondents surveyed, 49 (13.7%) were lecturers, while 308 (86.3%) were students. This implies that students constituted the majority of the respondents, reflecting their greater population within the selected Colleges of Education.

Research Question 1: What are the perceptions of lecturers and students on the adoption of Artificial Intelligence in accounting education in Colleges of Education in North Central Nigeria?

Table 2: Descriptive statistics on the perceptions of lecturers and students on the adoption of Artificial Intelligence in accounting education in Colleges of Education in North Central Nigeria

S/N	Statement	Mean ($\bar{X}$)	SD	Decision
1	Artificial Intelligence can improve the teaching and learning of Accounting.	2.78	0.84	Accepted
2	AI tools make Accounting concepts easier to understand.	2.65	0.81	Accepted
3	I am willing to use Artificial Intelligence in Accounting instruction/learning.	2.52	0.90	Accepted
4	AI adoption will improve academic performance in Accounting.	2.80	0.77	Accepted
5	Artificial Intelligence does not makes Accounting learning more interactive.	2.48	0.88	Rejected
6	AI-based learning is not better than traditional teaching methods in some areas of Accounting.	2.40	0.92	Rejected
7	I believe AI is relevant to modern Accounting education.	2.90	0.73	Accepted
8	AI can enhance problem-solving skills in Accounting students.	2.76	0.80	Accepted



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S/N	Statement	Mean ($\bar{X}$)	SD	Decision
9	The use of AI will increase students' interest in Accounting courses.	2.55	0.85	Accepted
10	Overall, I have a positive perception of AI adoption in Accounting education.	2.70	0.79	Accepted

Field Survey, 2026

Table 2 presents the descriptive statistics on the perceptions of lecturers and students regarding the adoption of Artificial Intelligence (AI) in accounting education in Colleges of Education in North Central Nigeria. The decision was based on a benchmark mean of 2.50, where mean scores of 2.50 and above were accepted, while those below 2.50 were rejected. The results indicate that respondents generally have a positive perception of the adoption of AI in accounting education. Specifically, respondents agreed that AI can improve the teaching and learning of Accounting (Mean = 2.78, SD = 0.84), suggesting that both lecturers and students recognize the potential of AI to enhance educational outcomes. Similarly, respondents agreed that AI tools make Accounting concepts easier to understand (Mean = 2.65, SD = 0.81), indicating that AI can facilitate comprehension of complex Accounting topics. The respondents also expressed willingness to use AI in Accounting instruction and learning (Mean = 2.52, SD = 0.90). Furthermore, they agreed that the adoption of AI can improve academic performance in Accounting (Mean = 2.80, SD = 0.77), demonstrating confidence in the effectiveness of AI-supported learning environments. However, the statement that "Artificial Intelligence does not make Accounting learning more interactive" was rejected (Mean = 2.48, SD = 0.88). Since the statement is negatively worded and was rejected, it implies that respondents believe AI actually makes Accounting learning more interactive. Likewise, the statement that "AI-based learning is not better than traditional teaching methods in some areas of Accounting" was rejected (Mean = 2.40, SD = 0.92), suggesting that respondents perceive AI-based learning as superior or more beneficial than traditional methods in certain aspects of Accounting education. The respondents further agreed that AI is relevant to modern Accounting education (Mean = 2.90, SD = 0.73), which recorded the highest mean score among the items. This indicates a strong recognition of the importance of AI in contemporary educational practices. They also agreed that AI can enhance problem-solving skills among Accounting students (Mean = 2.76, SD = 0.80) and increase students' interest in Accounting courses (Mean = 2.55, SD = 0.85). The respondents agreed that they have an overall positive perception of AI adoption in Accounting education (Mean = 2.70, SD = 0.79). The relatively low standard deviation values across the items indicate that the responses were fairly consistent among the lecturers and students.

Research Question: What are the perceived benefits of Artificial Intelligence in the teaching and learning of Accounting among lecturers and students in Colleges of Education in North Central Nigeria?

Table 3: Descriptive statistics on the perceived benefits of Artificial Intelligence in the teaching and learning of Accounting among lecturers and students in Colleges of Education in North Central Nigeria

S/N	Statement	Mean ($\bar{X}$)	SD	Decision
11	AI helps in automatic grading of Accounting assignments and tests.	2.62	0.83	Accepted
12	AI provides immediate feedback to students in Accounting.	2.58	0.86	Accepted
13	AI supports personalized learning in Accounting education.	2.75	0.80	Accepted
14	AI improves accuracy in financial calculations and analysis.	2.88	0.74	Accepted
15	AI enhances lecturers' efficiency in instructional delivery.	2.70	0.82	Accepted
16	AI helps students to learn Accounting at their own pace.	2.60	0.85	Accepted
17	AI does not reduces workload for lecturers in marking and record keeping.	2.45	0.90	Rejected
18	AI improves understanding of complex Accounting topics.	2.82	0.78	Accepted
19	AI does not increase students' engagement in Accounting classes.	2.40	0.91	Rejected
20	AI helps bridge the gap between theory and practical Accounting skills.	2.67	0.83	Accepted

Field Survey, 2026

Table 3 presents the descriptive statistics on the perceived benefits of Artificial Intelligence (AI) in the teaching and learning of Accounting among lecturers and students in Colleges of Education in North Central Nigeria. The decision was based on a criterion mean of 2.50, where mean scores of 2.50 and above were accepted, while those below 2.50 were



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rejected. The findings reveal that respondents generally perceived Artificial Intelligence as beneficial to Accounting education. The respondents agreed that AI helps in the automatic grading of Accounting assignments and tests (Mean = 2.62, SD = 0.83), indicating that AI can facilitate assessment processes and reduce the time required for grading. Similarly, respondents agreed that AI provides immediate feedback to students in Accounting (Mean = 2.58, SD = 0.86), suggesting that AI can enhance the learning process by enabling students to identify and correct errors promptly. The respondents also agreed that AI supports personalized learning in Accounting education (Mean = 2.75, SD = 0.80), implying that AI technologies can accommodate individual learning needs and learning pace. Furthermore, they agreed that AI improves accuracy in financial calculations and analysis (Mean = 2.88, SD = 0.74). This item recorded the highest mean score, indicating a strong belief among lecturers and students that AI can enhance precision and reduce errors in Accounting-related tasks. The findings further showed that respondents agreed that AI enhances lecturers' efficiency in instructional delivery (Mean = 2.70, SD = 0.82) and helps students learn Accounting at their own pace (Mean = 2.60, SD = 0.85). These results suggest that AI can improve teaching effectiveness while also supporting self-directed learning among students. The statement that "AI does not reduce workload for lecturers in marking and record keeping" was rejected (Mean = 2.45, SD = 0.90). Since the statement is negatively worded and was rejected, it implies that respondents believe AI actually reduces lecturers' workload in marking, grading, and record management. Likewise, the statement that "AI does not increase students' engagement in Accounting classes" was rejected (Mean = 2.40, SD = 0.91), indicating that respondents perceive AI as a tool that can enhance students' participation and engagement during Accounting lessons. The respondents agreed that AI improves understanding of complex Accounting topics (Mean = 2.82, SD = 0.78), suggesting that AI can simplify difficult concepts and facilitate deeper comprehension. They also agreed that AI helps bridge the gap between theory and practical Accounting skills (Mean = 2.67, SD = 0.83), highlighting its usefulness in connecting classroom instruction with real-world Accounting applications.

Research Question 3: What challenges affect the adoption of Artificial Intelligence in accounting education as perceived by lecturers and students in Colleges of Education in North Central Nigeria?

Table 4: Descriptive statistics on the challenges affect the adoption of Artificial Intelligence in accounting education as perceived by lecturers and students in Colleges of Education in North Central Nigeria

S/N	Statement	Mean ($\bar{X}$)	SD	Decision
21	Lack of ICT infrastructure limits the use of Artificial Intelligence in my institution.	2.95	0.76	Accepted
22	High cost of implementing AI tools affects their adoption.	2.90	0.78	Accepted
23	Many lecturers and students lack adequate ICT skills for AI use.	2.85	0.80	Accepted
24	Poor internet connectivity hinders the use of AI in learning.	3.05	0.74	Accepted
25	Lack of training opportunities affects AI adoption in Accounting education.	2.80	0.82	Accepted
26	Inadequate funding limits the integration of AI in Colleges of Education.	3.10	0.70	Accepted
27	Resistance to change affects the adoption of AI in teaching and learning.	2.35	0.88	Rejected
28	Limited access to computers and digital devices is a major challenge.	2.98	0.75	Accepted
29	Fear of job replacement reduces lecturers' acceptance of AI.	2.30	0.92	Rejected
30	Institutional policies do not fully support AI adoption in education.	2.88	0.79	Accepted

Field Survey, 2026

Table 4 presents the descriptive statistics on the challenges affecting the adoption of Artificial Intelligence (AI) in accounting education as perceived by lecturers and students in Colleges of Education in North Central Nigeria. The decision was based on a criterion mean of 2.50, with mean scores of 2.50 and above accepted, while those below 2.50 were rejected. The findings indicate that respondents perceived several infrastructural, financial, and institutional factors as major challenges to the adoption of AI in accounting education. Respondents agreed that lack of ICT infrastructure limits the use of Artificial Intelligence in their institutions (Mean = 2.95, SD = 0.76). This suggests that inadequate technological facilities such as computer laboratories, AI-enabled software, and digital learning environments constitute a significant barrier to AI

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integration. The respondents also agreed that the high cost of implementing AI tools affects their adoption (Mean = 2.90, SD = 0.78). This implies that the financial requirements associated with acquiring, maintaining, and updating AI technologies pose difficulties for many Colleges of Education. Similarly, respondents agreed that many lecturers and students lack adequate ICT skills for AI use (Mean = 2.85, SD = 0.80), indicating that insufficient digital literacy remains a challenge to effective utilization of AI technologies. Furthermore, poor internet connectivity was identified as a major obstacle to AI adoption (Mean = 3.05, SD = 0.74). This finding reflects the reality of many educational institutions in Nigeria where unstable internet services hinder access to online AI tools and digital learning platforms. Respondents also agreed that lack of training opportunities affects AI adoption in Accounting education (Mean = 2.80, SD = 0.82), suggesting that both lecturers and students require more exposure and capacity-building programmes to effectively utilize AI technologies. The respondents further agreed that inadequate funding limits the integration of AI in Colleges of Education (Mean = 3.10, SD = 0.70). This item recorded the highest mean score among all the challenges, indicating that funding is perceived as the most significant barrier to AI adoption. Additionally, respondents agreed that limited access to computers and digital devices is a major challenge (Mean = 2.98, SD = 0.75), while institutional policies were also perceived as not fully supportive of AI adoption in education (Mean = 2.88, SD = 0.79). However, the statement that resistance to change affects the adoption of AI in teaching and learning was rejected (Mean = 2.35, SD = 0.88). This suggests that lecturers and students are generally willing to embrace AI technologies and do not consider resistance to innovation a major obstacle. Likewise, the statement that fear of job replacement reduces lecturers' acceptance of AI was rejected (Mean = 2.30, SD = 0.92), implying that respondents do not perceive job insecurity as a significant factor influencing AI adoption. The findings reveal that the major challenges affecting the adoption of Artificial Intelligence in accounting education in Colleges of Education in North Central Nigeria are inadequate funding, poor internet connectivity, lack of ICT infrastructure, insufficient ICT skills, limited access to digital devices, inadequate training opportunities, and weak institutional support. In contrast, resistance to change and fear of job displacement are not considered significant barriers to the adoption of AI in accounting education.

Research Hypotheses

Table 5: Summary of t-test Analysis on Perceptions of Lecturers and Students on AI Adoption in Accounting Education

Variables	No	Mean	SD	Df	t-cal	t-tab	L. sig	Remarks
Lecturers	49	2.74	0.81	355	1.32	1.96	0.05	Not Sig.
Students	308	2.70	0.79					

Source: Field Survey, 2026

Table 5 shows that the calculated t-value of 1.32 at 355 degrees of freedom and 0.05 level of significance is less than the critical table value of 1.96. This indicates that there is no significant difference between the mean responses of lecturers and students on the adoption of Artificial Intelligence in accounting education in Colleges of Education in North Central Nigeria. Therefore, the null hypothesis (H01) is accepted.

Table 6: Summary of t-test Analysis on Benefits of Artificial Intelligence in Accounting Education

Variables	No	Mean	SD	Df	T-Cal	T-Tab	L. Sig	Remarks
Lecturers	49	2.78	0.77	355	1.58	1.96	0.05	Not Sig.
Students	308	2.73	0.80					

Source: Field Survey, 2026

Table 6 shows that the calculated t-value of 1.58 at 355 degrees of freedom and 0.05 level of significance is less than the critical table value of 1.96. This indicates that there is no significant difference between the mean responses of lecturers and students on the perceived benefits of Artificial Intelligence in the teaching and learning of Accounting. Therefore, the null hypothesis (H02) is accepted.

Table 7: Summary of t-test Analysis on Challenges Affecting Adoption of Artificial Intelligence in Accounting Education

Variables	No	Mean	SD	Df	t-cal	t-tab	L. sig	Remarks
Lecturers	49	2.92	0.76	355	1.21	1.96	0.05	Not Sig.
Students	308	2.89	0.78					



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Source: Field Survey, 2026

Table 7 shows that the calculated t-value of 1.21 at 355 degrees of freedom and 0.05 level of significance is less than the critical table value of 1.96. This indicates that there is no significant difference between the mean responses of lecturers and students on the challenges affecting the adoption of Artificial Intelligence in accounting education in Colleges of Education in North Central Nigeria. Therefore, the null hypothesis (H03) is accepted

Discussion of Findings

The result of research question 1 revealed that lecturers and students have a generally positive perception of the adoption of Artificial Intelligence (AI) in accounting education. The respondents agreed that AI can improve the teaching and learning of Accounting, make Accounting concepts easier to understand, enhance problem-solving skills, improve academic performance, and increase students' interest in accounting courses. They also considered AI relevant to modern Accounting education and expressed a willingness to use AI in instructional delivery and learning activities. Furthermore, the rejection of the statements that AI does not make learning more interactive and that AI-based learning is not better than traditional teaching methods suggests that respondents believe AI can enhance interactivity and complement conventional teaching approaches. This finding aligns with the study of Zawacki-Richter et al. (2023), who reported that students and educators generally perceive AI positively because of its potential to personalize learning, improve engagement, and enhance academic outcomes. Similarly, UNESCO (2023) observed that AI technologies have become increasingly accepted in educational settings due to their ability to support innovative teaching and learning practices. The finding is also consistent with Adewale and Ibrahim (2023), who found that Nigerian students viewed AI-based educational tools as useful for improving understanding of complex academic concepts. However, the finding contradicts the results of some earlier studies that reported reservations regarding AI adoption. For instance, Holmes et al. (2022) found that some educators were skeptical about the reliability of AI systems and expressed concerns about overdependence on technology in the learning process. The difference may be attributed to the growing awareness and exposure to AI technologies in recent years, especially with the widespread use of intelligent learning applications and generative AI tools in education. The positive perception observed among lecturers and students suggests a readiness to embrace AI technologies in accounting education, provided that adequate support and resources are made available.

The result of research question 2 revealed that lecturers and students perceive numerous benefits associated with the adoption of AI in accounting education. The respondents agreed that AI assists in automatic grading of assignments and tests, provides immediate feedback to learners, supports personalized learning, improves the accuracy of financial calculations and analysis, enhances lecturers' instructional efficiency, and helps students learn at their own pace. They also agreed that AI improves understanding of complex Accounting topics and bridges the gap between theoretical knowledge and practical Accounting skills. Additionally, the rejection of the statements that AI does not reduce lecturers' workload and does not increase students' engagement implies that respondents believe AI contributes positively to reducing administrative burdens and enhancing classroom participation. These findings support the work of Luckin et al. (2022), who reported that AI technologies improve teaching effectiveness by automating repetitive tasks and enabling educators to focus on more meaningful instructional activities. The findings are also in agreement with UNESCO (2023), which emphasized that AI can provide personalized learning experiences and improve students' academic achievement through adaptive learning systems. Similarly, Zawacki-Richter et al. (2023) found that AI applications facilitate timely feedback, improve learner engagement, and enhance academic performance in higher education institutions. Furthermore, the finding that AI improves accuracy in financial calculations and analysis is consistent with the views of Sutton, Holt, and Arnold (2023), who argued that AI-powered tools enhance precision in accounting processes and support analytical decision-making. The finding also corroborates the assertion by the International Federation of Accountants (IFAC, 2024) that AI technologies are transforming accounting education by integrating practical and technology-driven learning experiences. But some scholars have expressed concerns regarding the effectiveness of AI in promoting meaningful engagement. For example, Selwyn (2022) argued that excessive reliance on AI may reduce human interaction in the learning process and could limit critical thinking if not properly managed. Despite these concerns, the present study demonstrates that lecturers and students largely recognize the educational benefits of AI in accounting instruction. The result of research question 3 showed that several challenges hinder the adoption of AI in accounting education. Respondents identified inadequate funding, poor internet connectivity, lack of ICT infrastructure, limited access to computers and digital devices, inadequate



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ICT skills among lecturers and students, insufficient training opportunities, and weak institutional policy support as major barriers. Among these challenges, inadequate funding and poor internet connectivity were perceived as the most significant obstacles to AI integration. This finding is consistent with UNESCO (2023), which identified inadequate technological infrastructure and insufficient funding as major constraints to AI adoption in educational institutions, particularly in developing countries. Similarly, the OECD (2024) reported that many institutions struggle to implement AI because of high costs associated with acquiring and maintaining AI technologies. The finding also supports the study by the National Universities Commission (2024), which noted that inadequate digital infrastructure and poor internet access remain significant barriers to educational technology adoption in Nigeria. The finding that many lecturers and students lack adequate ICT skills is in agreement with the study of Aremu and Adeyemi (2023), who found that limited digital competence among educators and learners negatively affects the implementation of emerging technologies in Nigerian tertiary institutions. Likewise, Eze and Chukwu (2024) reported that insufficient training opportunities hinder the effective utilization of AI tools in higher education. However, the study found that resistance to change and fear of job replacement were not perceived as major barriers to AI adoption. This finding contrasts with the work of Holmes et al. (2022), who reported that some educators expressed concerns about the possibility of AI replacing certain teaching functions. It also differs from Selwyn (2022), who found that fear of technological displacement contributed to resistance toward AI implementation in some educational settings. The difference may be attributed to the increasing awareness among Nigerian lecturers and students that AI is intended to complement rather than replace human instruction. The findings indicate that the challenges affecting AI adoption in accounting education are largely structural and institutional rather than attitudinal. Therefore, improving funding, infrastructure, internet connectivity, ICT competence, and policy support will be critical to the successful integration of AI into accounting education in Colleges of Education in North Central Nigeria

Conclusion

Based on the findings of the study, it is concluded that lecturers and students in Colleges of Education in North Central Nigeria generally hold a positive perception toward the adoption of Artificial Intelligence (AI) in accounting education. The study established that AI is viewed as a valuable instructional tool capable of improving teaching effectiveness, simplifying complex Accounting concepts, enhancing students' understanding, and increasing academic performance and interest in accounting courses. The study also concludes that Artificial Intelligence offers significant pedagogical benefits in the teaching and learning of Accounting. These benefits include automatic grading of assignments, provision of immediate feedback, personalized learning opportunities, improved accuracy in financial computations, enhanced instructional efficiency for lecturers, and better student engagement. AI was also found to bridge the gap between theoretical knowledge and practical Accounting skills, thereby improving the overall quality of accounting education. The study further concludes that the adoption of Artificial Intelligence in accounting education is constrained by inadequate funding, poor internet connectivity, insufficient ICT infrastructure, lack of access to digital devices, limited ICT skills among lecturers and students, inadequate training opportunities, and weak institutional policy support.

Recommendations

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

1. Government and relevant educational authorities should increase funding for Colleges of Education to support the acquisition, installation, and maintenance of Artificial Intelligence tools and digital learning infrastructure required for effective Accounting instruction.
2. Institutions should invest in the provision of stable and high-speed internet connectivity to facilitate seamless access to AI-powered learning platforms and digital instructional resources.
3. Regular training and capacity-building programmes should be organized for lecturers and students to improve their ICT skills and enhance their ability to effectively integrate Artificial Intelligence into accounting teaching and learning processes.
4. Colleges of Education should upgrade and expand their ICT infrastructure, including computer laboratories, smart classrooms, and access to relevant AI-based educational software to support modern instructional delivery.
5. Institutional and national education policymakers should develop clear and supportive policies that encourage the integration of Artificial Intelligence in accounting education while ensuring ethical use and academic integrity.
6. AI tools should be introduced gradually into accounting curriculum delivery in a blended learning approach so as to complement traditional teaching methods and ensure smooth transition.



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7. Educational stakeholders should promote awareness and sensitization programmes to further strengthen positive perception and acceptance of Artificial Intelligence among lecturers and students.

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Leveraging Artificial Intelligence-Enhanced Technical and Vocational Education and Training for Sustainable Skills and Economic Development in Lagos State, Nigeria

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Abstract

This study assessed the potential of artificial intelligence (AI) to transform Technical and Vocational Education and Training (TVET) pedagogy in Lagos State, addressing the persistent skills mismatch that has left over 40% of Nigerian youth unemployed while critical sectors face severe skilled personnel shortages. On the basis of systematic desk review of academic literature, policy documents, and industry reports published between 2015 and 2026, the study identifies five key AI technologies applicable to TVET including adaptive learning platforms, intelligent tutoring systems, virtual/augmented reality, AI chatbots, and predictive analytics. Drawing on the Unified Theory of Acceptance and Use of Technology and Sen's Capability Approach, the study analyzes adoption barriers including unreliable infrastructure, severe shortages of AI-competent instructors, outdated curricula, inadequate funding, and policy fragmentation. The paper presents a conceptual framework linking AI-enhanced TVET to the achievement of Sustainable Development Goals, with specific indicators calibrated for Lagos State's industrial ecosystem. Findings indicate that AI can optimize curriculum design through real-time labor market data, provide scalable hands-on training through simulation, and deliver personalized feedback to learners. The study proposes actionable recommendations for digital infrastructure, teacher up-skilling programs, localized AI content development, and ethical data governance frameworks. The study contributes to the literature on digital transformation in education through the development of a context-sensitive framework for the integration of AI integration in Nigerian TVET, with implications for other federating Nigerian states and developing economies facing similar skills challenges.

Keywords: Artificial intelligence, TVET pedagogy, vocational training, skills development, workforce readiness

Introduction

The global work landscape has been fundamentally altered by the Fourth Industrial Revolution (4IR). Digitalization, automation, and intelligent systems are displacing routine physical jobs while concurrently creating demand for new technical skills in domains including data analytics, computer-aided design, digital fabrication, machine operation, robotics, 3D printing, and precision manufacturing (Schwab, 2017; World Economic Forum, 2020). For economies such as Nigeria, this transformation presents both opportunities and risks—the chance to leapfrog traditional industrial stages or the danger of marginalization due to misaligned workforce skills. Global agencies including UNESCO and the International Labour Organization have recognized Technical and Vocational Education and Training (TVET) as a critical instrument for equipping individuals with job-relevant skills, fostering entrepreneurship, and driving inclusive economic growth (UNESCO, 2016; ILO, 2020). The development and strengthening of TVET systems enables skill development, minimizes youth unemployment, and entrenches innovation and industrial competitiveness as experienced in developed economies (Eichhorst et al., 2015). Despite Nigeria's vast human and natural resources, the development of an effective TVET system has failed to meet the demands of industries and a rapidly changing economy. While youth unemployment exceeds 40% with 20% of the labor force underemployed (National Bureau of Statistics, 2022), employers report persistent challenges finding workers with adequate technical skills, digital literacy, and problem-solving abilities (Boyejo & Oke, 2025;



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Deloitte, 2021). This skills mismatch imposes significant costs on firms, reduces productivity (Okwuchukwu, 2025), and constrains Nigeria's ability to achieve SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 10 (Reduced Inequalities). Lagos State, as Nigeria's economic powerhouse contributing over 30% of the nation's GDP and hosting the highest concentration of industries, construction firms, and technology companies, faces the acute manifestation of this skills challenge. The state's population of over 22 million, with a median age of 22 years, generates enormous demand for skilled technical workers. Yet TVET institutions in Lagos struggle with outdated equipment, insufficient digital infrastructure, and curricula disconnected from the state's dynamic industrial landscape (Lagos State Ministry of Education, 2023).

Problem Statement

Nigeria's TVET pedagogy remains largely traditional, lecture-based, and disconnected from the digital tools and competencies that define modern workplaces and labour market needs (ADERINTO, 2026; Nwakile, 2026). Curricula are infrequently updated, instructional resources are outdated or unavailable, and student-to-instructor ratios often exceed expected standards (Okolie et al., 2020). Consequently, graduates emerge without the hands-on experience or adaptive skills required by employers. Despite accommodating Nigeria's largest concentration of TVET institutions, Lagos State continues to report significant skills shortages in critical sectors. A 2023 Lagos State Employment Trust Fund (LSETF) report identified that over 60% of manufacturing firms in Lagos struggle to find technicians with adequate digital competencies, while construction companies report that 70% of new hires require extensive retraining (LSETF, 2023). The Lagos State Government's T.H.E.M.E.S. Agenda explicitly identifies skills development as a priority, yet implementation of digital transformation in TVET remains nascent. Despite the transformative potential of artificial intelligence in education (Kumar et al., 2023; Lin et al., 2023), there is a scarcity of empirical studies on systematic integration of AI into TVET systems. Most existing studies focus on general higher education or developed country contexts. Even more limited is research addressing the Lagos State context, where rapid urbanization, significant informal sector activity, and a thriving technology ecosystem create both unique opportunities and distinct challenges for AI adoption. This study therefore seeks to answer: How can artificial intelligence be strategically integrated into TVET pedagogy in Lagos State to enhance graduate employability and contribute to the achievement of sustainable development goals?

Research Objectives

The objectives of this research are to:

1. Identify the specific AI technologies relevant to enhancing TVET pedagogy within the Lagos State context.
2. Analyze the current challenges and barriers to AI adoption in Nigeria's TVET system, with particular emphasis on the Lagos State institutional landscape.
3. Propose a conceptual framework and actionable strategies for integrating AI into TVET curriculum delivery, assessment, and industry alignment.
4. Demonstrate how AI-enhanced TVET can directly advance Sustainable development goals (SDG 4, SDG 8, SDG 9, and SDG 10) in the Nigerian context.

Research Methodology

This study employs a desk study methodology to investigate the strategic integration of AI into TVET pedagogy in Lagos State. According to Naoum (2007), a desk study involves systematic analysis of existing secondary data sources, including literature, reports, and institutional documents, without requiring primary data collection. This approach is particularly suitable as it enables comprehensive synthesis of findings from peer-reviewed literature, industry and agency reports and policy documents. The study is founded on two complementary theoretical frameworks. The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) provides a lens for understanding technology adoption behavior through four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. In the Lagos TVET context, these constructs help explain how educators' beliefs about AI effectiveness, perceived ease of use, peer and policy pressures, and infrastructure availability shape AI adoption decisions. The Capability Approach (Sen, 1999) complements this by focusing on what individuals are able to do and become, emphasizing that AI-enhanced TVET is valuable not only for increasing employment rates but also for expanding learners' capabilities to choose meaningful work, adapt to economic changes, and participate in digital society. Data were drawn from systematic searches of academic databases (Web of Science and Google Scholar), institutional repositories, and news archives for materials published between 2015 and 2026. The Keywords used includes "artificial intelligence," "AI," "Technical and vocational education,"



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"TVET," "Lagos State," "LSETF," "sustainable development goals" and "SDGs" guided the search. Sources were screened for relevance to AI integration in TVET and the Lagos State context, with priority given to peer-reviewed articles, official reports, and recent publications. Thematic analysis was applied to analyze the data extracted, involving familiarization with sources, generation of initial codes, refinement into coherent thematic categories, interpretation of patterns, and synthesis of findings to develop the conceptual framework and recommendations. Limitations include access constraints to certain documents, inability to independently verify some statistical claims, and reliance on secondary source accuracy.

Literature Review

Evolution and Current State of TVET in Nigeria

In Nigeria, the TVET system is founded on colonial-era trade schools and indigenous apprenticeship systems (Nwabueze, 2016). Today, TVET is delivered through three main channels: (1) public technical colleges offering National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC); (2) polytechnics awarding National Diploma (ND) and Higher National Diploma (HND); and (3) informal apprenticeships, which train a considerable number of construction and artisan workers (Ebekozen et al., 2024; ITF, 2019). Despite this institutional infrastructure, multiple systemic weaknesses persist. A 2021 World Bank assessment rated Nigerian TVET quality as "low" on international benchmarks, citing inadequate workshop equipment, poorly trained instructors, and weak certification standards (World Bank, 2021). The Industrial Training Fund has attempted to modernize curricula through the National Occupational Standards, but implementation remains uneven. Moreover, TVET enrollment is disproportionately low, reflecting persistent societal bias against vocational pathways (Okolie & Yasin, 2017). Lagos State presents a distinctive TVET landscape. The state hosts three federal TVET institutions (Yaba College of Technology, Federal College of Education (Technical) Akoka, and Federal Science and Technical College Yaba), eight state-owned technical colleges, and numerous private vocational training centers. A 2022 Lagos State TVET audit revealed that less than 30% of technical college workshops had functional modern equipment, and fewer than 20% of instructors had received training in digital pedagogy in the preceding five years (Lagos State Ministry of Education, 2022).

AI in Education: Global Trends and Typologies

Over the past decade, artificial intelligence has rapidly evolved in education. Baker (2019) distinguishes between three AI waves: (1) AI as a tutor (intelligent tutoring systems, adaptive learning); (2) AI as a tutee (where students teach AI); and (3) AI as a tool (analytics dashboards, automated administration). For TVET, the first and third waves are most relevant.

Key AI technologies applicable to TVET include:

Intelligent Tutoring Systems: ITS simulate human one-on-one tutoring by providing step-by-step guidance, immediate feedback, and natural language dialogue. Lagos's booming construction sector presents a prime application area for ITS targeting construction-related competencies especially considering that building and construction accounts for **19.60%** of the state's GDP (Osae-Brown, 2013, April 21).

Adaptive Learning Platforms (ALPs): Systems that use machine learning algorithms to dynamically adjust content difficulty, pacing, and presentation style based on individual learner performance. In the Lagos context, where class sizes are often large, ALPs could enable personalized attention at scale (Silas et al., 2024).

Virtual Reality (VR) and Augmented Reality (AR): VR creates fully immersive simulated environments; AR overlays digital information onto the physical world. For Lagos State, VR simulations could reduce training costs and workplace accidents while addressing limited physical space for expanding workshop facilities (Mwanje, 2025; Kassa, 2021)).

AI Chatbots and Virtual Assistants: Natural language processing systems that answer student questions, provide reminders, offer career guidance, and triage technical problems. Considering Lagos's high mobile phone penetration, chatbots accessible via WhatsApp could be particularly effective and scalable (see, Potor, 2025; Innovation Village Nigeria, 2025; Meta Platforms, n.d.)

Predictive Analytics and Learning Analytics: Using historical and real-time data to forecast student performance, identify at-risk learners, and recommend interventions. Lagos's concentration of industry and technology companies means that labor market data is abundant, enabling alignment between TVET outputs and employer requirements.

Empirical Evidence of AI Impact on TVET Outcomes In developing countries

Evidence from middle-income contexts shows the potential of AI. In India, the National Skill Development Corporation implemented an AI-driven career guidance chatbot named "Arya," which reached over 1 million youth, significantly increasing enrollment in high-demand courses (NSDC, 2020). The BORESHA project in Kenya, applied AI-powered



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mobile learning for agricultural TVET which resulted in increased student retention and faster skill mastery (World Bank, 2021). In Colombia, VR simulation training for industrial welding reduced training costs by 40% and improved first-time certification pass rates by 35% (SENA, 2019). Available evidence from Lagos, though limited, is promising. At Yaba College of Technology, a 2023 initiative utilised an adaptive learning platform for computer science courses and reported considerable improvement in pass rates compared to conventional instruction method (Adebari et al., 2023). These evidence suggest that AI can overcome common challenges faced in TVET including lack of qualified instructors (through ITS), expensive equipment (through VR), geographic isolation (through mobile AI), and slow curriculum response (through analytics).

Gaps in Nigeria's AI Adoption for TVET

A systematic gap analysis shows multi-dimensional deficits:

Infrastructure and access to digital connection: Studies (including Nweke & Onu, 2022) identify that less than 40% of TVET institutions have access reliable internet; about 20% have computers less than 5 years old. This signifies that key barriers persist including inadequate infrastructure, unreliable electricity, and poor internet connectivity (Okeowo et al., 2025).

Human Capacity and Teacher Training: Alakali et al. (2021) identify that about 80% of TVET teachers lacks adequate digital pedagogy training. The lack of instructor training is a critical barrier to AI adoption in Lagos TVET programs (Okeowo et al., 2025).

Policy and Governance: Whereas, no national strategy for AI in TVET was found, scanty Institutional Policy Support moderator for ethical AI adoption (Ayanwale et al., 2025), and Digital Transformation in Nigeria have begun to emerge (NBTE, 2025).

Curriculum and Assessment: According to Onatere-Ubrurhe & Ubrurhe, (2025), existing assessments signify significant gaps in evaluating creativity and innovation.

Financial Constraints: As against UNESCO recommendation of 10%, TVET gets 5% of the total education budget in Nigeria (ThisDay. 2025, October 23), High upfront and recurrent costs present significant barriers (UNESCO, 2016). However, TVET initiative are beginning to receive incremental funding (Tribune Online. 2026, March 8).

Barriers to AI Adoption in Nigeria's TVET System

Table 1: Barriers to AI Adoption in TVET in Nigeria, with Emphasis on Lagos State

Challenge Category	National Barrier	Lagos Specific Findings	Reference
Infrastructure and Digital Access	Inadequate infrastructure including unreliable electricity and limited internet connectivity	Moderate technology integration observed but hampered by unreliable electricity, poor internet, and insufficient computing hardware	Vincent & Emmanuel (2025); Okeowo et al. (2025)
Human Capacity and Teacher Training	Critical shortage of trained educators skilled in using digital and AI tools	Vocational educators show moderate awareness of AI but preparedness hindered by lack of training	Vincent & Emmanuel (2025); Isikilu et al. (2025)
Policy and Institutional Support	Lack of clear, coherent institutional and national policies for AI in TVET	Weak policy support identified as a significant systemic barrier	Okeowo et al. (2025); Ayanwale et al. (2025)
Curriculum and Assessment	Outdated curricula insufficient for equipping students with AI and digital skills	Some curriculum innovations exist but insufficient to meet needs of an AI-driven economy	Dawodu et al. (2025); Onatere-Ubrurhe & Ubrurhe (2025)
Financial Constraints	High costs for acquiring, implementing, and maintaining AI tools	High implementation costs consistently cited as major hurdles	Onatere-Ubrurhe & Ubrurhe (2025); IARD (2024)
Socio-Cultural and Digital Literacy	Resistance to change and general lack of digital literacy	Resistance to change identified as a major barrier alongside digital literacy gaps	Wahab et al. (2026); The Frontier (2025)



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Conceptual Framework for AI-Enhanced TVET for SDG Achievement

The study's conceptual framework posits that AI technologies (ALS, ITS, VR/AR, chatbots, analytics) interact with three mediating factors: (1) Digital infrastructure; (2) Human capacity; and (3) Supportive policy. AI-enhanced TVET leads to three proximal outcomes: personalized learning, scalable hands-on training, and real-time industry alignment. These, in turn, drive ultimate development outcomes corresponding to SDGs.

Table 2: Proximal Outcomes, SDG Linkages, and Indicators for AI-Enhanced TVET

Proximal Outcome	SDG Linkage	Lagos State Indicators
Personalized, inclusive learning	SDG 4 - Quality Education	Reduced dropout rates in Lagos TVET institutions; improved pass rates in Lagos trade examinations
Workforce skills for Industry 4.0	SDG 8 - Decent Work & Growth	Employment rates of Lagos TVET graduates within 6 months; reduction in skills mismatch reported by employers
Technical capacity for local industry	SDG 9 - Industry & Innovation	Proportion of Lagos manufacturing and construction firms reporting skilled technician availability
Rural access to quality training	SDG 10 - Reduced Inequalities	Parity in training access between urban Lagos and peri-urban areas; employment rates of youth in underserved communities

Recommendations for AI Integration in Nigerian TVET

The following policy recommendations are structured across short-term (1–2 years) and medium-term (3–5 year) horizons to provide a phased approach to AI integration in TVET. Short-term actions focus on immediate directives and foundational planning, while medium- long term measures establish enduring institutional frameworks and sustainable financing mechanisms.

For Short-term (1–2 Years), the recommendation are:

1. National Level: Curriculum Reform Mandate

Directive to NBTE mandating curriculum revision for priority trades to incorporate AI literacy and digital competencies with clear timelines and assessment benchmarks should be provided.

2. Lagos State Level: State-Specific AI in TVET Roadmap

The Lagos State Executive should mandate LASTVEB to develop an AI in TVET roadmap that aligns with the T.H.E.M.E.S. Agenda, identifying priority trades, phased targets, infrastructure needs, and industry engagement mechanisms.

For Medium-term (3–5 Years), the recommendations include:

1. National AI in Education Policy with TVET Annex

A National AI in Education Policy with a dedicated TVET annex covering infrastructure standards, teacher certification, data privacy, and ethical guidelines, ensuring sustainability should be enacted.

2. TVET Technology Matching Grant

A grant program enabling private sector donations for AI hardware and software , leveraging private investment while ensuring value for money should be established.

3. Mandate Labour Market Analytics as Permanent ITF Function

Industrial Training Fund should be mandated to conduct quarterly labour market analytics to align TVET curricula with employer demands, thus, providing data-driven decision-making to the TVET sector.

For Long-term (6–10 Years), it is recommended that:

1. Establish a National TVET-AI Research and Development Centre

Create a dedicated national research center focused on developing indigenous AI solutions for TVET, including NLP models for Nigerian languages, locally relevant technical content, and context-appropriate adaptive learning systems. This center would serve as a hub for innovation, policy research, and knowledge dissemination.

2. Institutionalize AI-Enhanced TVET Quality Assurance Framework

Develop and mandate a comprehensive quality assurance framework for AI-enhanced TVET delivery, covering



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standards for AI tool deployment, student data protection, algorithmic transparency, and continuous program evaluation. This would ensure consistent quality across all TVET institutions nationwide.

3. Integrate AI Competencies into National TVET Teacher Certification

Make AI literacy and digital pedagogy competencies a mandatory component of the national teacher certification framework for TVET instructors, ensuring that all new and existing educators possess foundational AI skills for effective instruction.

4. Establish State-Level AI-TVET Implementation Units

Mandate each state government to establish dedicated AI-TVET implementation units within their respective TVET boards, responsible for coordinating state-specific AI integration efforts, monitoring progress, and reporting to the National AI-in-TVET Task Force.

5. Establish National AI-TVET Monitoring and Evaluation Framework

Deploy a national monitoring and evaluation framework that tracks AI integration progress, measure learning outcomes, and assess employment impacts across all TVET institutions should be established to aid evidence-based policy reviews.

Conclusion

This study has systematically assessed the potential of artificial intelligence to transform technical and vocational education pedagogy in Nigeria. The desk review reveals that AI technologies provide concrete solutions to existing TVET challenges: adaptive learning systems enable personalized instruction at scale; intelligent tutoring systems deliver immediate feedback; VR/AR provide safe, repeatable hands-on practice; chatbots offer 24/7 student support; and predictive analytics align curricula with labor market demands. However, the analysis also identifies interlocking barriers: unreliable electricity and internet; acute shortages of AI-competent instructors; outdated curricula; severe underfunding; policy fragmentation; and socio-cultural resistance. The Lagos State context intensifies both opportunities and challenges. The state's position as Nigeria's economic powerhouse generates enormous demand for skilled technical workers, yet its TVET institutions struggle with insufficient digital infrastructure, weak policy support, and a shortage of digitally competent instructors. The proposed conceptual framework links AI interventions to quality education (SDG 4), decent work (SDG 8), industry and innovation (SDG 9), and reduced inequalities (SDG 10). The recommendations provide a coherent roadmap for Lagos State's institutional ecosystem, leveraging existing partnerships with development organizations and the Lagos State Employment Trust Fund.

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Correlation Between Integration of Artificial Intelligence Technology and Inclusive Learning Experiences among University Undergraduate Students in Edo State, Nigeria

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Abstract

This study focused on examining the relationship between artificial intelligence and inclusive learning experiences among university students in Edo State. Three hypotheses guided the study. A correlational survey research design was adopted. The population comprised undergraduate students of the University of Benin and Ambrose Alli University, Ekpoma, Edo State. A sample size of 350 respondents was selected using a multi-stage sampling technique. Data were collected using a structured questionnaire titled Artificial Intelligence and Inclusive Learning Experiences Questionnaire (AIILEQ) consisting of 30 items measured on a four-point rating scale. The instrument was validated by three experts from the University of Benin, Benin city, while reliability was established through the test-retest method, yielding a reliability coefficient of 0.84. Data were analyzed using simple linear regression analysis with the aid of SPSS at the 0.05 level of significance. Findings revealed that students' awareness of artificial intelligence had a significant relationship with their inclusive learning experiences. The study also revealed that students' utilization of artificial intelligence tools had a significant relationship with their inclusive learning experiences. Furthermore, students' competence in using artificial intelligence was found to have a significant relationship with their inclusive learning experiences. The study concluded that improving students' awareness, utilization, and competence in artificial intelligence is essential for promoting inclusive learning experiences in universities in Edo State.

Keywords: Artificial Intelligence, Awareness, Utilization, Competence, Inclusive Learning Experiences

Introduction

Education remains a fundamental instrument for national development, human capital formation, and social transformation. Universities, as centres of knowledge creation, innovation, and professional development, are expected to prepare students with the knowledge, competencies, and skills required to thrive in an increasingly digital, interconnected, and knowledge-driven society. In recent decades, rapid technological advancement has transformed the landscape of higher education, changing not only how knowledge is delivered but also how students access, process, and apply information. Among these technological innovations, artificial intelligence (AI) has emerged as one of the most transformative developments influencing teaching, learning, assessment, research, and academic support services. Artificial intelligence refers to computer systems and technologies capable of performing tasks that traditionally require human intelligence, including reasoning, learning, language processing, problem-solving, decision-making, personalized recommendations, and data analysis (Hwang et al., 2020). Within university education, AI has expanded learning opportunities beyond the conventional classroom by providing students with continuous access to educational resources, intelligent tutoring systems, adaptive learning platforms, virtual assistants, educational chatbots, and collaborative digital learning environments. The increasing integration of artificial intelligence into higher education has shifted learning from a teacher-centred approach towards a more learner-centred, flexible, and personalized experience. Students are no longer restricted to physical classrooms or fixed instructional schedules but are increasingly able to learn at their own pace, access information on demand, receive individualized academic support, and engage with diverse learning resources regardless of geographical location or time. This transformation aligns with the growing emphasis on inclusive learning, which advocates equitable educational opportunities for all learners irrespective of differences in ability, gender, socioeconomic status, language, culture, or learning needs. Inclusive learning extends beyond mere physical access to education; it encompasses the creation of learning environments in which every student is able to participate meaningfully, engage actively, access appropriate learning resources, and achieve academic success without experiencing barriers to learning. Artificial intelligence offers



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considerable potential for achieving these goals by providing adaptive instructional support, multilingual communication, personalized feedback, assistive technologies, and accessible learning materials that respond to individual learning characteristics (Pagliara et al., 2024). Globally, universities are increasingly incorporating artificial intelligence into academic activities to improve teaching effectiveness, students' engagement, collaboration, accessibility, and learning experiences. AI-powered educational technologies have transformed learning beyond traditional classroom settings by supporting independent learning, collaborative problem-solving, virtual mentoring, and intelligent knowledge management. According to Kuleto et al. (2021), artificial intelligence technologies facilitate collaborative learning environments, improve students' academic skills, and enhance engagement within higher education institutions. Similarly, Jia and Tu (2024) reported that AI capabilities strengthen students' learning motivation, self-efficacy, and inclusiveness by providing personalized learning experiences and adaptive academic support. These developments demonstrate that artificial intelligence has become an essential component of contemporary higher education and a valuable resource for promoting inclusive learning experiences among university students. While the availability of artificial intelligence technologies presents numerous educational opportunities, students can only benefit from these technologies when they possess adequate awareness of their existence, capabilities, educational applications, and ethical implications. Artificial intelligence awareness refers to students' knowledge, understanding, recognition, and familiarity with AI technologies and their potential applications in learning and academic activities. Awareness enables students to identify appropriate AI tools, understand their educational value, appreciate their limitations, and make informed decisions regarding their academic use. Students who possess greater awareness of AI are more likely to explore its educational possibilities, develop positive attitudes toward its adoption, and utilize AI-supported learning resources effectively. Ayuso-del Puerto et al. (2026) found that university students' knowledge and perceptions of artificial intelligence significantly influence their understanding of inclusive education and their willingness to adopt AI-supported learning approaches. Likewise, El-Shara et al. (2025) reported that students' awareness and attitudes toward artificial intelligence applications positively influence their educational experiences and contribute to more effective and inclusive learning practices. These findings suggest that awareness constitutes an important foundation for students' engagement with AI technologies and may influence their inclusive learning experiences. Beyond awareness, the educational value of artificial intelligence depends largely on students' utilization of AI tools for learning. Artificial intelligence utilization refers to the frequency, extent, and manner in which students employ AI-powered technologies to support academic activities such as information retrieval, assignment preparation, academic writing, language translation, collaborative learning, personalized tutoring, content generation, research assistance, and problem-solving. The increasing availability of applications such as ChatGPT, educational chatbots, virtual tutors, intelligent search systems, Grammarly, Google Gemini, Microsoft Copilot, and adaptive learning platforms has expanded students' opportunities to learn independently and interact with educational content in more flexible ways. Effective utilization of these technologies has the potential to improve students' participation, engagement, accessibility, and overall learning experiences by reducing learning barriers and providing immediate academic support. Alyoussef et al. (2025) observed that perceived usefulness and ease of use significantly influence university students' adoption of artificial intelligence for collaborative and inclusive learning. Similarly, Khalid et al. (2026) found that AI and digital learning technologies positively affect student engagement and support inclusive educational practices among university students. These findings imply that students who make greater educational use of AI technologies may experience more inclusive learning than those who make little or no use of such technologies. Closely related to utilization is students' competence in using artificial intelligence. While awareness enables students to recognize AI technologies and utilization reflects the extent of their use, competence represents students' ability to use these technologies effectively, responsibly, critically, and ethically to achieve academic goals. Artificial intelligence competence encompasses AI literacy, digital literacy, information evaluation skills, ethical awareness, problem-solving abilities, and the practical capability to operate and integrate AI applications into learning activities. Competent students are expected to use AI not merely as a source of information but as an intelligent academic support tool capable of enhancing critical thinking, creativity, collaboration, and independent learning. Asghar et al. (2025) reported that artificial intelligence literacy significantly contributes to collaborative knowledge practices and inclusive leadership development among higher education students. Reyes and Meneses (2024) also emphasized the importance of AI literacy for students and educators in promoting inclusive learning environments within universities. Furthermore, Huang (2021) argued that AI education contributes substantially to developing the competencies required for learners to function effectively in the twenty-first century. These studies



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suggest that students' competence in AI may determine the extent to which they benefit from AI-supported learning opportunities and experience inclusive learning. Inclusive learning experiences constitute the educational outcomes that students derive from participating in learning environments that are equitable, accessible, engaging, supportive, and responsive to individual learning differences. Inclusive learning experiences reflect students' perceptions of equal opportunities to participate in classroom and online learning activities, access educational resources, receive appropriate academic support, collaborate with peers, and overcome barriers associated with learning differences or technological limitations. Within AI-supported educational environments, inclusive learning experiences are enhanced when students can effectively utilize intelligent technologies to meet their individual learning needs, participate actively in academic activities, and achieve meaningful educational outcomes irrespective of their backgrounds or abilities. Consequently, understanding the factors that contribute to students' inclusive learning experiences has become increasingly important as universities continue integrating AI into teaching and learning processes. The relationship between artificial intelligence and inclusive learning has received increasing scholarly attention in recent years. Existing literature tend to indicate that artificial intelligence contributes to personalized instruction, accessibility, learner engagement, academic support, and improved educational outcomes for diverse groups of learners. Li et al. (2025) observed that AI technologies improve students' learning outcomes and engagement by providing individualized instructional support and adaptive learning experiences. Similarly, Melo-López et al. (2025) found that AI applications facilitate the adaptation of learning environments to students' individual needs, thereby promoting educational inclusion. Salas-Pilco et al. (2022) further reported that artificial intelligence and other emerging educational technologies enhance students' self-efficacy, competence, participation, and academic performance, particularly among diverse and minority learners. Collectively, these studies demonstrate the potential of AI to promote inclusive learning experiences through personalized, accessible, and learner-centred educational practices. Although there appears to be a growing body of international research on artificial intelligence in higher education, empirical evidence from Nigerian universities seems to remain relatively limited. Existing studies have tended to focus primarily on technology adoption, digital learning, AI literacy, and students' acceptance of AI applications, while comparatively fewer studies appear to have examined the relationship between students' awareness of artificial intelligence, utilization of AI tools, competence in using AI, and their inclusive learning experiences. Furthermore, many of these studies have been conducted in developed countries, where technological infrastructure, institutional support, and levels of digital literacy may differ from those found in many developing countries, including Nigeria. As a result, it may not be appropriate to assume that the findings of such studies fully reflect or adequately explain the context and realities of Nigerian universities. In Edo State, universities are increasingly embracing digital technologies to improve teaching, learning, and academic administration. Students are becoming more exposed to AI-powered educational applications that support learning beyond the traditional classroom through personalized tutoring, automated feedback, intelligent information retrieval, and collaborative online learning. However, despite the growing availability of these technologies, there is insufficient empirical evidence regarding whether students' awareness of artificial intelligence, their utilization of AI tools, and their competence in using AI are associated with their inclusive learning experiences. This lack of empirical evidence creates a knowledge gap that limits policymakers, university administrators, and educators in designing evidence-based strategies for integrating AI in ways that promote equitable and inclusive learning.

Research Objectives

The following research objectives guided the study:

1. To determine the relationship between students' awareness of artificial intelligence and their inclusive learning experiences in universities in Edo State.
2. To determine the relationship between students' utilization of artificial intelligence tools and their inclusive learning experiences in universities in Edo State.
3. To determine the relationship between students' competence in using artificial intelligence and their inclusive learning experiences in universities in Edo State.

Research Questions

The following research questions will guide the study:



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1. What is the relationship between students' awareness of artificial intelligence and their inclusive learning experiences in universities in Edo State?
2. What is the relationship between students' utilization of artificial intelligence tools and their inclusive learning experiences in universities in Edo State?
3. What is the relationship between students' competence in using artificial intelligence and their inclusive learning experiences in universities in Edo State?

Hypotheses

The following hypotheses will be tested at the 0.05 level of significance:

- H₀₁:** There is no significant relationship between students' awareness of artificial intelligence and their inclusive learning experiences in universities in Edo State.
- H₀₂:** There is no significant relationship between students' utilization of artificial intelligence tools and their inclusive learning experiences in universities in Edo State.
- H₀₃:** There is no significant relationship between students' competence in using artificial intelligence and their inclusive learning experiences in universities in Edo State.

Research Methodology

This study adopted a correlational survey research design. The design was considered appropriate because it enabled the researcher to collect data from respondents and determine the relationship between students' awareness of artificial intelligence, utilization of artificial intelligence tools, competence in using artificial intelligence, and inclusive learning experiences in universities in Edo State without manipulating any of the variables. The population of the study comprised all undergraduate students of the University of Benin and Ambrose Alli University, Ekpoma, Edo State. A sample size of 350 undergraduate students was selected for the study using a multi-stage sampling technique. First, the two universities were purposively selected because they are among the major public universities in Edo State. Thereafter, faculties and departments were selected using simple random sampling, while proportionate sampling was used to allocate respondents to each university. Finally, accidental sampling technique was used to select the respondents who participated in the study. The instrument used for data collection was a structured questionnaire developed by the researcher titled Artificial Intelligence and Inclusive Learning Experiences Questionnaire (AIILEQ). The questionnaire was designed to elicit information on students' awareness of artificial intelligence, utilization of artificial intelligence tools, competence in using artificial intelligence, and inclusive learning experiences. The instrument consisted of two sections. Section A elicited respondents' demographic information, while Section B contained items measuring the variables of the study. The questionnaire was structured on a four-point rating scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), weighted 4, 3, 2, and 1 respectively. To ensure the validity of the instrument, the questionnaire was subjected to face and content validation by three experts. These comprised two lecturers from the Department of Curriculum and Instructional Technology and one expert in Measurement and Evaluation, all from the University of Benin, Benin City. Their comments, observations, and suggestions were used to modify ambiguous statements, improve the clarity of the items, and ensure that the instrument adequately measured the variables under investigation. The corrections made by the validators were incorporated into the final version of the instrument before administration. The reliability of the instrument was established using the test-retest method. The questionnaire was administered to 30 undergraduate students from Delta State University, Abraka, who were not part of the study population. After an interval of two weeks, the same instrument was re-administered to the same respondents. The two sets of scores obtained were correlated using the Pearson Product Moment Correlation Coefficient, which yielded a reliability coefficient of 0.84, indicating that the instrument was reliable and suitable for data collection. Data for the study were collected by the researcher with the assistance of two trained research assistants. Before the administration of the questionnaire, permission was obtained from the relevant university authorities, while the respondents were informed of the purpose of the study and assured that the information provided would be treated with strict confidentiality and used solely for academic purposes. Copies of the questionnaire were administered personally to the respondents and retrieved immediately or within an agreed period to ensure a high retrieval rate. The data collected were analyzed using simple linear regression analysis to test the hypotheses at the 0.05 level of significance. The decision rule was that any hypothesis with a probability (p) value less than 0.05 was rejected, while any hypothesis with a probability (p) value equal to or greater than 0.05 was accepted.

Presentation of Results

Hypothesis 1: There is no significant relationship between students' awareness of artificial intelligence and their inclusive learning experiences in universities in Edo State.

Table 1: Regression Analysis of Students' AI Awareness and their Inclusive Learning experiences in Universities in Edo State

R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.428	0.183	0.181	3.214			
Model	Sum of Squares	df	Mean Square	F	Sig.	
Regression	812.456	1	812.456	78.627	0.000	
Residual	3595.781	348	10.333			
Total	4408.237	349				
Coefficients						
Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	
(Constant)	21.436	1.286		16.669	0.000	
AI Awareness	0.371	0.042	0.428	8.867	0.000	

Table 1 shows the F-value of 78.627 and a p-value of 0.000. Testing the hypothesis at an alpha level of 0.05, the p-value of 0.000 was less than the alpha level of 0.05. Hence, the null hypothesis which states that there is no significant relationship between students' awareness of artificial intelligence and their inclusive learning experiences in universities in Edo State was rejected. This implies that there is a significant relationship between students' awareness of artificial intelligence and their inclusive learning experiences in universities in Edo State. The R-Square value of 0.183 revealed that 18.3% variance in inclusive learning was accounted for by students' AI awareness. The unstandardized coefficient (B) for predicting inclusive learning from AI awareness was 0.371. The standardized coefficient (Beta) was 0.428, $t = 8.867$. Hence, students' AI awareness was significant at the 0.05 level.

Hypothesis 2: There is no significant relationship between students' use of artificial intelligence and their inclusive learning experiences in universities in Edo State.

Table 2: Regression Analysis of Students' AI Use and their Inclusive Learning Experiences in Universities in Edo State

R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.391	0.153	0.151	3.274			
Model	Sum of Squares	df	Mean Square	F	Sig.	
Regression	674.293	1	674.293	62.912	0.000	
Residual	3733.944	348	10.730			
Total	4408.237	349				
Coefficients						
Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	
(Constant)	20.882	1.451		14.392	0.000	
Students' AI Utilization	0.346	0.044	0.391	7.932	0.000	

Table 2 shows the F-value of 62.912 and a p-value of 0.000. Testing the hypothesis at an alpha level of 0.05, the p-value of 0.000 was less than the alpha level of 0.05. Therefore, the null hypothesis which states that there is no significant relationship between students' utilization of artificial intelligence and their inclusive learning experiences in universities in Edo State was rejected. This implies that there is a significant relationship between students' utilization of artificial



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intelligence and their inclusive learning experiences in universities in Edo State. The R-Square value of 0.153 revealed that 15.3% variance in inclusive learning was accounted for by students' AI use. The unstandardized coefficient (B) was 0.346, while the standardized coefficient (Beta) was 0.391, $t = 7.932$. Thus, students' AI utilization was significant at the 0.05 level.

Hypothesis 3: There is no significant relationship between students' competence in artificial intelligence and their inclusive learning experiences in universities in Edo State.

Table 3: Regression Analysis of Students' AI Competence and their Inclusive Learning Experiences in Universities in Edo State

R	R Square	Adjusted R Square		Std. Error of the Estimate		
0.512	0.262	0.260		3.056		
Model	Sum of Squares	df	Mean Square	F	Sig.	
Regression	1154.958	1	1154.958	123.691	0.000	
Residual	3253.279	348	9.349			
Total	4408.237	349				
Coefficients						
Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	
(Constant)	18.764	1.217		15.418	0.000	
AI Competence	0.492	0.044	0.512	11.122	0.000	

Table 3 shows the F-value of 123.691 and a p-value of 0.000. Testing the hypothesis at an alpha level of 0.05, the p-value of 0.000 was less than the alpha level of 0.05. Therefore, the null hypothesis which states that there is no significant relationship between students' competence in artificial intelligence and their inclusive learning experience in universities in Edo State was rejected. This indicates that there is a significant relationship between students' competence in artificial intelligence and their inclusive learning experiences in universities in Edo State. The R-Square value of 0.262 revealed that 26.2% variance in inclusive learning was accounted for by students' AI competence. The unstandardized coefficient (B) was 0.492, while the standardized coefficient (Beta) was 0.512, $t = 11.122$. Therefore, students' AI competence was significant at the 0.05 level.

Discussion of Findings

The findings of this study revealed that there is a significant relationship between students' awareness of artificial intelligence and their inclusive learning experiences in universities in Edo State. This implies that students who possess greater awareness of artificial intelligence are more likely to experience equitable access to learning opportunities, active participation, and meaningful engagement in the teaching and learning process. The finding agrees with Ayuso-del Puerto et al. (2026), who found that university students with greater knowledge and awareness of artificial intelligence demonstrated more positive perceptions of inclusive education and were more willing to adopt AI-supported learning approaches. The finding is also consistent with Raphael et al. (2025), who reported that awareness of artificial intelligence tools among undergraduate students, particularly those with disabilities, promotes the utilization of intelligent learning technologies that enhance accessibility and multisensory learning experiences. The study also found that there is a significant relationship between students' utilization of artificial intelligence and their inclusive learning experiences in universities in Edo State. This indicates that students who frequently utilize artificial intelligence tools for academic activities are more likely to experience improved participation, collaboration, engagement, and equitable learning opportunities. The finding supports Alyoussef et al. (2025), who reported that the adoption and utilization of artificial intelligence technologies significantly enhance collaborative learning and promote inclusive learning environments in higher education institutions. The finding also aligns with Khalid et al. (2026), who found that artificial intelligence and digital learning technologies positively influence students' engagement and participation while supporting inclusive educational practices in universities. Finally, the study revealed that there is a significant relationship between students' competence in using artificial intelligence and their inclusive learning experiences in universities in Edo State. This implies



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that students who possess higher levels of competence in using artificial intelligence technologies are more likely to benefit from inclusive learning through improved problem-solving skills, personalized learning, collaboration, and active participation in academic activities. The finding is in agreement with Asghar et al. (2025), who reported that artificial intelligence literacy and competence significantly enhance collaborative knowledge practices, inclusive leadership development, and students' participation in higher education. The finding also supports Costache and Enăchescu (2026), who emphasized that the development of artificial intelligence competencies among university students is essential for fostering global competence, inclusive education, and sustainable higher education.

Conclusion

The study revealed that students' awareness, utilization, and competence in using artificial intelligence have significant relationships with their inclusive learning experiences in universities in Edo State. This implies that students who are more aware of artificial intelligence, utilize AI tools effectively, and possess the competence to apply them appropriately are more likely to experience improved participation, engagement, accessibility, and collaboration in learning. The study therefore concludes that promoting artificial intelligence awareness, utilization, and competence is essential for enhancing inclusive learning experiences in universities in Edo State.

Recommendations

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

1. University management should organize regular awareness programmes on the educational applications of artificial intelligence to improve students' understanding and acceptance of AI technologies.
2. Lecturers should encourage the appropriate use of artificial intelligence tools in teaching and learning to enhance students' participation and inclusive learning experiences.
3. Universities should provide regular training on artificial intelligence skills and integrate AI literacy into academic programmes to improve students' competence in using AI for learning.

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Influence of Group Learning Strategy using Classroom Activities on Academic Performance among Basic 8 Science Students in Gboko Metropolis, Benue State, Nigeria

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Abstract

This study "Evaluate the Influence of Group Learning Strategies using Classroom Activities on the Academic Achievement of Basic 8 Science Students in Gboko Metropolis, Benue State." 2 research questions and 2 hypotheses guided the study. A quasi experimental, pretest post-test design was adopted for the study. A total of Basic 8 students from 30 secondary schools form the population for the study. A total of 150 students (60 males and 90 females) from 3 secondary school in Gboko metropolis selected by multi-stage sampling technique constituted the sample. One instrument namely. Basic science performance test developed by the researcher and validated were used for data collection. The reliability coefficient of the instrument was established through a pilot study using Kuder Richardson KR-21 formula which was found to be 0.82. The data collected were analyzed using mean, standard deviation and ANCOVA. The study revealed that students in the experimental group performed statistically significant higher mean scores than students in the control group. The study showed that there was gender disparity in mean academic performance when male and female students were taught using group learning strategy, and group learning strategy with classroom activities. The study also revealed that the interaction effect of gender and strategy had no significant effect on students' academic performance. Based on the findings the study recommends among other things that Basic science teachers should use group learning strategy with classroom activities as a medium of instruction to enhance performance in Basic Science.

Keywords: Basic Science, Group Learning Strategy, Classroom Activities, Academic Performance, Students

Introduction

The intellectual, technological, and economic underpinnings of society are shaped by science education, which is essential to national progress. Concerns regarding junior secondary school pupils' poor performance in Basic Science have led to proposals for pedagogical changes in Nigeria. In order to promote deeper comprehension and academic accomplishment, new solutions like group learning and structured classroom activities are necessary because traditional lecture approaches frequently fail to engage students actively. Since science plays such a broad and significant role in today's world, Atoo (2018) emphasized the value of scientific knowledge in raising a nation's natural prestige, military prowess, national wealth, and international standing. Science and technology give birth to the production of micro-computers and their innovative applications which earned the developed countries such as United States of America and Japan unparalleled national wealth, military potential and enviable national prestige. It is a basic fact that, for an individual to be well groomed in science and be competent enough to face the challenges of life in his or her society he or she must have a good foundation in science and technology. This is because science and technology has contributed enormously in solving societal problems in many areas such as health, nutrition, food, security, and transportation, security sports, among others (Tofi, et al, 2017). As a result of science and technology, education is increasingly conducted in non-traditional settings outside of schools, such as homes, workplaces, industries, and marketplaces. Nigeria and other countries around the world are working hard to advance technologically and scientifically because it has broken down barriers to education, whether they be economic, demographic, or environmental (Atoo, 2018) (Adejoh, et al, 2013). (Okwara, et al, 2019) claim that countries that are regarded as developed and generally civilized have attained that status by strategically and purposefully educating their



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citizens in science. Science education in Nigeria has become significant because it is needed to produce technologists, technicians, scientists, craftsmen and skilled artisans who are required to change the economy which would in turn lead to a rapid growth and development necessary for nations to cope with the present day challenges (Samuel, 2018). However, science education cannot achieve the goal of producing technologist, technicians, scientists, craftsmen and skilled artisans for national development when the achievement of students in science subjects especially Basic Science and Technology which is the foundation of science education is not encouraging enough. The analysis of students' performance released by Benue State Examinations Board (2023) revealed that in 2023, 78, 960 candidates took the examination 22,260 (28, 19 %) had distinction, 39, 647 (50.21%) had credit, 9,418 (11.93%) has pass and 7,635 (9.67%) failed. The performance in the subject is not good enough to boast of as a foundation subject upon which pure science at senior secondary school and science education generally anchored on. As stated by Okwara et al. (2019), the state of basic science and technology performance is caused by a number of factors, including a lack of qualified basic science and technology teachers, a lack of students' exposure to class activities, a lack of preparation on the part of teachers and students, and an inability to successfully implement the curriculum. (Adeniran, et al 2018) attribute the low performance in the Basic Science course to a number of factors, including incompetent teachers, inadequate facilities and resources for instruction, poor student backgrounds, inadequate funding for science and technology education, a lack of awareness among the majority of parents, a lack of motivation among teachers and students, and poor administration by different institution heads.

The poor performance of students in Basic Science remains a major concern for teachers, parents, and education stakeholders in Nigeria. Despite government efforts such as curriculum reforms, teacher training, provision of laboratory equipment, and the promotion of innovative teaching methods, students' achievement has remained unsatisfactory. Contributing factors include ineffective teaching methods, inadequate teacher preparation, insufficient learning resources, poor infrastructure, overcrowded classrooms, and socio-cultural influences. Although the integration of technology, group learning strategies, and classroom activities has the potential to improve learning outcomes, their effectiveness is often limited by inadequate resources and resistance to change. Therefore, improving students' performance in Basic Science requires sustained investment in educational infrastructure, teacher professional development, and the adoption of learner-centered instructional approaches. The teaching of Basic Science should be students centered, activity oriented where rote learning and memorization is discouraged. For this purpose, the use of discovery teaching strategy, the inclusion of group learning and the involvement of students in open ended field or laboratory exercises have been advocated for, (Ityokyaa and Adejoh, 2014). All these strategies recommended are inquiry based. For an individual to be productive and functional in a changing society, he or she must acquire the right attitude and functional skills which can only be cultivated in learners through appropriate teaching of science using innovative strategies. Basic Science forms the bedrock of scientific literacy and serves as a precursor to advanced scientific studies and technical education. However, performance metrics have consistently indicated low proficiency levels among Nigerian students, attributed to factors such as outdated teaching practices, inadequate facilities, and a lack of student engagement. The Benue State Examinations Board (2023) reported that while over 78,000 candidates took the Basic Science examination, fewer than 30% attained distinction a clear signal of systemic gaps. To bridge these gaps, this study focuses on the application of group learning strategies and classroom activities, both of which align with contemporary constructivist and experiential learning paradigms. These approaches emphasize student-centered learning, collaboration, and the practical application of scientific concepts, contrasting sharply with the passive reception of information typical of lecture-based teaching. By integrating these methods, educators can create a more interactive and inclusive classroom environment that supports critical thinking, peer interaction, and higher retention.

Group learning is a learning strategy that organizes students in small groups so that they can work together to maximize the learning of others. In particular, the group learning approach is the situation where students are organized in pairs or in small groups to help each other in learning the assigned material (Ajaja & Eravwoke, 2012). (Gambari, et al, 2016), also defined group learning as a way of learning in which students of different ability levels work together in small group to achieve a goal. It involves the use of a variety of leaning activities to improve the understanding of a topic. Students in a group interact with each other, share ideas and information, seek for additional information and make decisions about their discoveries for the whole class. There are four Basic elements in the group learning strategy. These basic elements include; small groups must be structured for positive interdependence, there must be face to face interactions, individual



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responsibility and use of interpersonal skills and small groups. It is known that group learning actively involves students in the learning process and seeks to improve the critical thinking, reasoning and problem solving skills of the learner (Ajaja & Mezieobi, 2018). The use of group learning strategy may have the same or different effect on male and female students. Classroom activities are practical and interactive learning experiences designed to improve students' understanding, critical thinking, skills, and overall engagement in the learning process. These activities, such as observation, investigation, discussion, games, and practical exercises, help students apply theoretical knowledge while promoting confidence and active participation (Iornyagh & Ihongu, 2019). According to Agia et al. (2022), classroom activities are instructional techniques used at different stages of a lesson introduction, content delivery, and conclusion to enhance students' learning, engagement, and interaction, while fostering positive relationships between teachers and students as well as among learners. Theoretically, Vygotsky Social Constructivism propounded in 1978, which states that learning is a social process, and knowledge is constructed through interaction and collaboration with others and Experiential Learning Theory propounded by David Kolb's, in 1984, which states that learning is a dynamic process that occurs through experience and active engagement. Kolb argued that knowledge is created through the transformation of experience, where individuals interact with their environment, reflect on their actions, and adapt their understanding. Empirically, Slavin (2021), Ogbeba and Ajayi (2018), Okoro and Olatunji (2019), who reported that cooperative and activity-based learning minimize gender disparities in science achievement. Johnson and Johnson (2019) and Eriba and Samuel (2018), who emphasized that cooperative and group-based learning approaches enhance academic achievement through collaboration and active engagement.

Statement of the Problem

The academic performance of Basic 8 science students is a major educational concern, as many students perform poorly due to traditional teacher-centered methods that limit engagement and collaboration. Although previous studies have shown that group learning strategies can improve critical thinking, cooperation, and understanding, few have examined their use alongside structured classroom activities specifically designed for science lessons. Additionally, there is limited research on this approach in Gboko Metropolis. Therefore, this study seeks to investigate the effects of group learning strategies combined with classroom activities on the academic performance of Basic 8 science students in Gboko Metropolis.

Purpose of the Study

The main purpose of this study is to "Evaluate the influence of Group Learning Strategies using Classroom Activities on the Academic performance of Basic 8 Science Students in Gboko Metropolis, Benue State." Specifically the study seeks to:

1. Determine whether the effect of group learning strategy using classroom activities on students' performance is gender biased
2. Determine the extent to which interaction of methods and gender affects students' performance in Basic Science

Research Questions

1. How does gender have influence on the performance of students when exposed to group learning strategy using classroom activities?
2. How would interactions of methods and gender affect students' performance in Basic Science?

Hypotheses

1. There is no significant difference between the mean performance scores of male and female students in Basic Science who are taught Basic Science using group learning strategy using classroom activities.
2. There is no significant interaction effect of methods and gender on mean students' performance in Basic Science

Research Methodology

The data that was collected in the course of this study was analyzed using statistical tools for data analysis which is descriptive and inferential statistics. Research questions were answered using mean scores and standard deviation while the null hypotheses were tested using Analysis of Covariance (ANCOVA) at a 0.05 level of significance. A quasi-experimental pretest-posttest design without random assignment was employed. The study population included approximately 20,000 Basic 8 students across 30 schools in Gboko Metropolis. A multistage sampling technique selected 150 students divided equally among experimental (group learning and activities) and control (lecture-based) groups. The BSPT instrument assessed performance pre- and post-intervention. The instrument was adopted by the researcher,



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validation by three experts from the Department of Science and Mathematics Education, Rev Fr Moses Orshio Adasu University, Gboko. Kuder Richardson Formula KR-21 was used to determine the reliability of BSPT. The Reliability Coefficient obtained was 0.82. Through a trial test conducted on 30 students who are part of the population but are not part of the sample for the study. The experimental groups were taught Basic Science concepts using Group learning strategy with Classroom Activities while the control groups were taught same concepts using Lecture method. The treatment was conducted in four weeks. After the four weeks teaching, the posttest was administered with the same BSPT. The BSPT scores were subjected to Analysis of Covariance (ANCOVA).

Presentation of Results

Research Question One: How does gender have influence on the performance of students when exposed to group learning strategy with classroom activities?

Table 1: Mean and Standard Deviation of Performance of Male and Female Students taught Basic Science using Group Learning Strategy with Classroom Activities (GLS+CA).

Gender		Pre-test	Post-test	Mean Gain
Male	Mean	11.46	20.23	8.77
	N	26	26	
	Std. Deviation	3.09	2.96	0.13
Female	Mean	11.96	19.96	8.00
	N	24	24	
	Std. Deviation	1.94	2.97	1.03
Mean Difference				0.77

Table 1 shows that both male and female Basic 8 students improved their academic performance in Basic Science after being taught using the Group Learning Strategy with Classroom Activities (GLS+CA). Male students' mean score increased from 11.46 (pre-test) to 20.23 (post-test), giving a mean gain of 8.77. Female students' mean score improved from 11.96 to 19.96, with a mean gain of 8.00. The difference in mean gain was 0.77 in favor of male students. The post-test standard deviations were 2.96 for males and 2.97 for females, indicating a similar level of consistency in performance. Overall, the findings suggest that GLS+CA was effective for both genders, with only a slight advantage for male students and no significant gender gap in achievement.

Hypothesis One: There is no significant difference between the mean performance scores of male and female students in Basic Science who are taught Basic Science using group learning strategy with classroom activities.

Table 2: ANCOVA of Mean Performance Scores of Male and Female Students taught Basic Science using Group Learning Strategy with Classroom Activities.

Dependent Variable: Post-test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	4.951 ^a	2	2.475	.279	.758	.012	
Intercept	800.065	1	800.065	90.057	.000	.657	
Pretest	4.024	1	4.024	.453	.504	.010	
Gender	1.327	1	1.327	.149	.701	.003	
Error	417.549	47	8.884				
Total	20623.000	50					
Corrected Total	422.500	49					

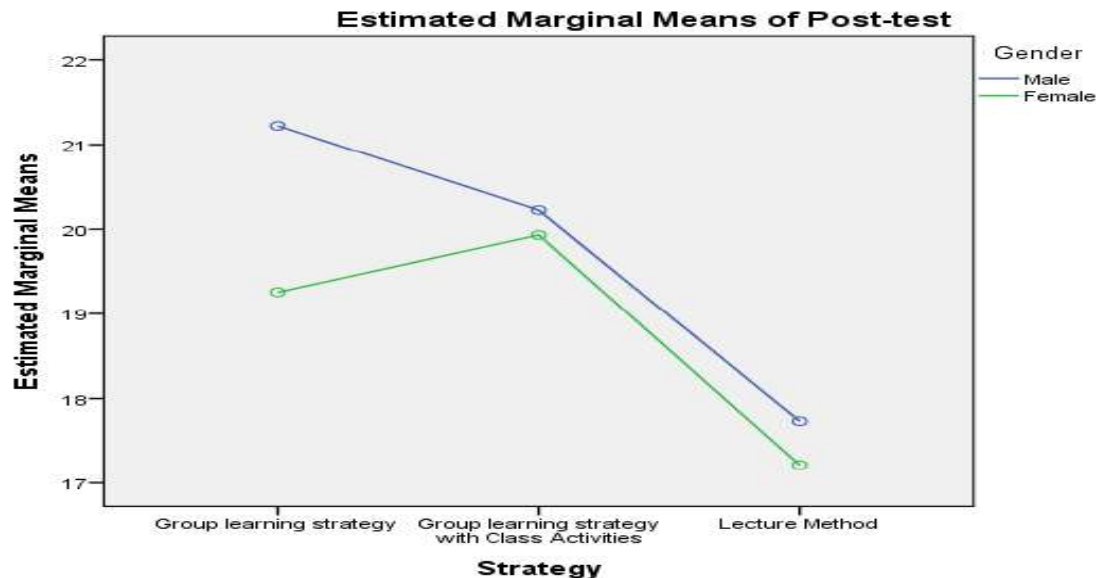
a. R Squared = .012 (Adjusted R Squared = -.030)

Table 2 indicates that there was no statistically significant difference in the academic performance of male and female students taught Basic Science using the Group Learning Strategy with Classroom Activities (GLS+CA). The analysis produced an F-value of 0.149 with a p-value of 0.701 ($p > 0.05$), leading to the acceptance of the null hypothesis. This means that both male and female students performed similarly after the intervention. Furthermore, the partial eta squared (η^2) value of 0.003 shows that gender accounted for only 0.3% of the variance in students' performance, indicating a very small effect size. Overall, the findings suggest that GLS+CA is equally effective for both male and female students.

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Research Question Two: How would interactions of methods and gender affect students' performance in Basic Science?

Table 3: Pair Wise Comparisons for Mean Academic Performance Scores of Students in Basic Science who are taught using Group Learning, Group Learning Strategy with Classroom Activities and conventional strategies



Covariates appearing in the model are evaluated at the following values: Pre-test = 11.27

Figure 1: Graphical Representation of Interaction Effect of Strategies and Gender on Students' Performance in Basic Science.

Dependent Variable: Post-test

(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig. ^b
Group learning strategy (GLS)	Group learning strategy with Class Activities	.163	.671	1.000
	Lecture Method	2.766*	.687	.000
	Group learning strategy	-.163	.671	1.000
Group learning strategy with Class Activities (GLS+CA)	Lecture Method	2.603*	.686	.001
	Group learning strategy	-2.766*	.687	.000
	Group learning strategy with Class Activities	-2.603*	.686	.001

Based on estimated marginal means *. The mean difference is significant at the .05 level

Table 3 shows that there was no significant difference in the academic performance of students taught using Group Learning Strategy (GLS) and Group Learning Strategy with Classroom Activities (GLS+CA), with a mean difference of -0.163, SE = 0.671, and $p = 1.000$ ($p > 0.05$). However, both instructional strategies were significantly more effective than the Lecture Method (LM). Students taught with GLS performed significantly better than those taught with LM (mean difference = 2.766, SE = 0.687, $p = 0.000$), while students taught with GLS+CA also outperformed those taught with LM (mean difference = 2.603, SE = 0.686, $p = 0.001$). The reverse comparisons (LM vs. GLS and LM vs. GLS+CA) further confirmed these significant differences ($p \leq 0.001$). Overall, the findings indicate that both GLS and GLS+CA are equally effective and produce significantly higher academic performance than the traditional lecture method.

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Hypothesis Two: There is no significant interaction effect of methods and gender on mean students' performance in Basic Science

Table 4: ANCOVA of Interaction Effect of Methods and Gender on Mean Students' Performance in Basic Science

Dependent Variable: Post-test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	298.312 ^a	6	49.719	4.431	.000	.157	
Intercept	2897.602	1	2897.602	258.239	.000	.644	
Pretest	1.575	1	1.575	.140	.709	.001	
Strategy	226.148	2	113.074	10.077	.000	.124	
Gender	31.995	1	31.995	2.851	.093	.020	
Strategies* Gender	20.552	2	10.276	.916	.403	.013	
Error	1604.548	143	11.221				
Total	57545.000	150					
Corrected Total	1902.860	149					

a. R Squared = .157 (Adjusted R Squared = .121)

Table 8 reveals that $F(2,143) = 0.916$; $p = 0.403 > 0.05$. Since p-value is greater than the significance level of 0.05, the null hypothesis is not rejected. This means that, no significant interaction effect exists between teaching strategies and gender on students' performance in Basic Science. The partial eta squared value of 0.013 for the strategies and gender implies that 13% of the difference in the students' performance can be accounted for by the strategies and gender. This indicates a low effect size.

Discussion of Findings

The study investigated the effects of Group Learning Strategy (GLS), Group Learning Strategy with Classroom Activities (GLS+CA), and the Lecture Method (LM) on Basic 8 students' achievement in Basic Science. The results showed that students exposed to GLS+CA recorded the highest mean gain (8.46), followed closely by GLS (8.40), while those taught with the Lecture Method had the lowest gain (7.12). The overall difference among the teaching strategies was statistically significant ($F(2,146) = 9.649$, $p < 0.05$), indicating that instructional method significantly affects students' performance. However, there was no significant difference between GLS and GLS+CA ($p > 0.05$), though both strategies significantly outperformed the lecture method ($p < 0.05$). This supports the view of Johnson and Johnson (2019) and Eriba and Samuel (2018), who emphasized that cooperative and group-based learning approaches enhance academic achievement through collaboration and active engagement. In terms of gender, students taught with GLS showed a slightly higher mean gain for males (9.29) than females (7.69), but the difference was not statistically significant ($F(1,47) = 3.710$, $p > 0.05$; $\eta^2 = 0.073$). Similarly, under GLS+CA, male students recorded 8.77 compared to 8.00 for females, also not significant ($F(1,47) = 0.149$, $p > 0.05$; $\eta^2 = 0.003$). This indicates that both strategies are gender-inclusive and equitable, consistent with the findings of Slavin (2021), Ogbeba and Ajayi (2018), and Okoro and Olatunji (2019), who reported that cooperative and activity-based learning minimize gender disparities in science achievement. Furthermore, the interaction effect between teaching strategies and gender was not significant ($F(2,143) = 0.916$, $p > 0.05$; $\eta^2 = 0.013$), meaning that the effectiveness of the teaching methods did not depend on gender. This aligns with findings by Usoro (2023) and Ibhafidon and Aduwa (2020), who concluded that student-centered instructional methods produce consistent learning gains across genders. Overall, the study supports the position of Adeyemi (2017) that participatory and cooperative teaching strategies significantly enhance academic achievement and promote equity in Basic Science education.

Conclusion

Based on the findings, it is evident that group learning strategies supported by classroom activities are more effective than traditional lecture methods in enhancing students' performance and interest in Basic Science. Therefore, implementing such strategies can contribute meaningfully to improved academic outcomes and student engagement at the Basic 8 level. Adopting these strategies can significantly contribute to raising science achievement and fostering a scientifically literate society.

Recommendations

1. Science teachers should adopt group learning strategies enhanced with classroom activities to improve academic outcomes in Basic Science.



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2. Curriculum planners should integrate cooperative learning models like Science-Text-Cards (STC) in the Basic Science curriculum.
3. School administrators should provide necessary support in terms of training and resources to implement active learning strategies

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Impact of Intentional Discipleship on Youth Lifestyle: A Case Study of ... Abel, A. A. & Umoru, R. F. (2026)

Impact of Intentional Discipleship on Youths' Lifestyle: A Case Study of God's Care Missions, Okpo, Olamaboro Local Government Area, Kogi State, Nigeria

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Abstract

This study investigated the influence of intentional discipleship on youth lifestyles at God's Care Missions (GCM), Okpo, Olamaboro Local Government Area, Kogi State, Nigeria. Driven by a pervasive moral and cultural decline among young people caused by unmonitored digital spaces, secular worldviews, and religious nominalism, this research evaluated the effectiveness of GCM's holistic disciple-making framework. Four research questions and four corresponding null hypotheses guided the study. The inquiry was theoretically anchored on Albert Bandura's Social Learning Theory and the Christian Discipleship Replication Paradigm. A descriptive survey research design was adopted. The population comprised youth directors, pastors, and missionary evaluators within the GCM Okpo network, from which a sample of 18 key stakeholders was selected using simple random sampling techniques. Data collection was executed via a researcher-developed instrument, the Influence of Discipleship on Youth Lifestyle Questionnaire (IDYLQ), validated by experts in practical theology and psychometrics. Descriptive statistics (Mean and Standard Deviation) answered the research questions, while Pearson Product Moment Correlation (PPMC) and Dependent Samples t-tests evaluated the hypotheses at a 0.05 level of significance. The empirical results led to the rejection of all four null hypotheses, demonstrating that high-proximity, life-on-life mentorship ($X=3.51$) and systematic expository catechesis ($X=3.50$) generate statistically significant shifts ($p < 0.05$) in youth character and worldview schemas. Furthermore, involving youth in practical community service outreach ($X=3.60$) and covenant fellowship cell structures ($X=3.56$) successfully countered secular peer pressure and cured individualistic behaviors. The study concludes that GCM's holistic framework effectively translates abstract theology into concrete lifestyle holiness, bridging the intergenerational communication gap within the mission. It is recommended that GCM expand its impact by structurally mandating that leaders devote at least 60% of their operational energy to relational mentoring and explicitly integrate spiritual tracking with agro-allied and digital vocational empowerment modules to foster self-reliance.

Keywords: Intentional Discipleship, Youth Lifestyle, Sound Doctrine, Practical Service, God's Care Missions.

Introduction

The survival and historical continuity of any missionary organization depends on its capacity to systematically pass its core theological mandates down to succeeding generations. Within contemporary youth ministries, this transmission often suffers from operational reductionism, degenerating into an endless loop of entertainment-driven programs, social activities, and emotional highs that fail to anchor young people when they encounter secular philosophies, societal pressures, or economic anxieties (Case, 2026; Choice, 2022). True Christian maturity does not occur through random environmental absorption; it requires a structured, relational, and deliberate strategy of spiritual replication. Discipleship transcends mere classroom lecturing or localized indoctrination; it is an intensive, life-on-life process of mentoring, training, and intentionally walking alongside young people to transform them into committed, self-replicating followers of Jesus Christ (Gbadebo, 2024). Inside rural and semi-urban Nigerian mission fields, this mandate faces severe operational friction. Local ministries are frequently caught between two competing extremes: a "reductionist evangelism" that prioritizes rapid numerical additions over spiritual depth, and a pervasive "prosperity gospel" that frames the Creator as an instrument for material self-gratification rather than an absolute Sovereign to be obeyed through cross-bearing holiness (Gbadebo, 2024; Marasigan, 2022). This dynamic takes on a vital, multi-dimensional execution when situated within a rural missional ecosystem. In the context of God's Care Missions (GCM), Okpo, an indigenous, rural-focused mission field, the structural operationalization of discipleship cannot be confined to the four walls of a sanctuary. Because rural communities often experience systemic socio-economic vulnerabilities, infrastructural deficits, and educational gaps, a scripturally authentic discipleship strategy must naturally integrate cognitive orthodoxy with visible, compassionate orthopraxy. Consequently, discipleship at GCM Okpo, heavily influenced by its founder, Evangelist Sunday Oguiche, uniquely expands into tangible, practical community impacts—including institutional feeding programs, communal



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healthcare/welfare initiatives, and localized academic and vocational teaching (*GCM Field Manual, 2025*). This holistic framework mirrors the early apostolic model, demonstrating that spiritual regeneration is verified through localized societal transformation. Therefore, analyzing how this dual-track strategy influences youth lifestyles remains a critical scholarly and missional imperative.

Statement of the Problem

The contemporary youth demographic in rural and semi-urban hubs like Okpo faces an unprecedented, aggressive confluence of digital distractions, shifting moral paradigms, and intense socio-economic pressures that actively deconstruct traditional Christian identity. Despite the rural setting, the rapid penetration of unmonitored digital mobile technology and global social media platforms has exposed young people to secularistic, hyper-individualistic philosophies that present moral compromise as personal freedom. This cultural shift creates a profound generational and relational rift between conservative, older church stakeholders—who frequently enforce traditional behavioral norms without clear biblical explanation—and a younger demographic that views such enforcement as rigid, legalistic isolation (*Choice, 2022; Gbadebo, 2024*). Consequently, youth attendance and meaningful engagement in core spiritual practices, such as midweek Bible expositions and corporate intercessory prayer meetings, have experienced a severe quantitative decline. Furthermore, this spiritual instability is dangerously aggravated by local economic vulnerabilities. Many under-discipled young people have fallen captive to financial shortcuts—including cyber-fraud (*Yahoo-Yahoo*), examination malpractice, and gambling syndicates—or have succumbed to faith-healing materialism that separates justification from an active lifestyle of sanctification (*Marasigan, 2022*). This creates a dualistic lifestyle where youth maintain outward church participation while internally succumbing to the behavioral patterns of their secular peers. The core of the problem lies in the structural absence of a uniform, systematic discipleship strategy across many local assemblies. Without an intentional, multi-generational mentoring framework—such as the apostolic Paul-Timothy model—the church lacks the operational mechanism to translate abstract theological truths into concrete, character-forming lifestyle changes. If this structural gap remains unaddressed at GCM Okpo, the mission risks raising a spiritually nominal generation, jeopardizing both its long-term missional legacy and the socio-spiritual stability of the entire region.

Research Questions

To provide a precise empirical evaluation of the GCM discipleship architecture, the following four research questions were investigated:

1. To what extent does intentional mentorship and leadership modeling shape the development of personal character and godliness among the youth at GCM, Okpo?
2. What is the influence of systematic sound doctrine instruction on the mental repositioning of youth toward a robust biblical worldview?
3. How does involving youth in practical community service outreach (orphans, widows, and vulnerable families) affect their social and community behavior?
4. To what extent does a supportive, family-like community fellowship cell structure foster mutual accountability and moral resilience among the youth?

Research Hypotheses

The following four null hypotheses were formulated to undergo statistical evaluation at a 0.05 level of significance:

- H₀₁: There is no significant relationship between intentional leadership mentorship/modeling and the development of personal godliness and character among the youth at GCM, Okpo.
- H₀₂: There is no significant relationship between systematic sound doctrine instruction and the mental repositioning of youth toward a robust biblical worldview.
- H₀₃: Involvement in practical community service outreach has no significant effect on the transformation of youth social and behavioral lifestyles within the Okpo community.
- H₀₄: There is no significant relationship between participation in community fellowship cell structures and the cultivation of moral accountability among the youth.

Theoretical Framework

This study is theoretically anchored on Albert Bandura's Social Learning Theory (1977) and the Christian Discipleship Replication Paradigm. Bandura posits that human behavior is extensively learned observationally through modeling. By

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observing seasoned models, an individual forms a cognitive schema of behaviors that serves as a coded guide for subsequent action. In the GCM Okpo network, this social-cognitive process explains the operational dynamics of youth mentorship: when young people are brought into direct, high-proximity contact with mature leaders, they observe Christlike character, sacrificial lifestyles, and moral integrity in real-time. This structural modeling bridges the intergenerational gap, allowing youth to internalize and replicate behavioral holiness (Case, 2026). Parallel to this, the *Discipleship Replication Paradigm*—derived from Christ’s life-on-life investment in the twelve (Mark 3:14) and the apostolic Paul-Timothy model (2 Timothy 2:2)—establishes that intellectual classroom lecturing alone cannot transform character. Character transmission requires close personal proximity, ongoing behavioral accountability, and practical mobilization. These dual frameworks demonstrate that when a mission integrates rigorous sound doctrine with living models of active compassion, it successfully alters both the internal cognitive worldview and the external social conduct of the young generation (Gbadebo, 2024; Marasigan, 2022).

Conceptual Framework: The GCM Holistic Discipleship Model

The core of your research hinges on a four-dimensional framework that progresses from internal transformation to external social responsibility:

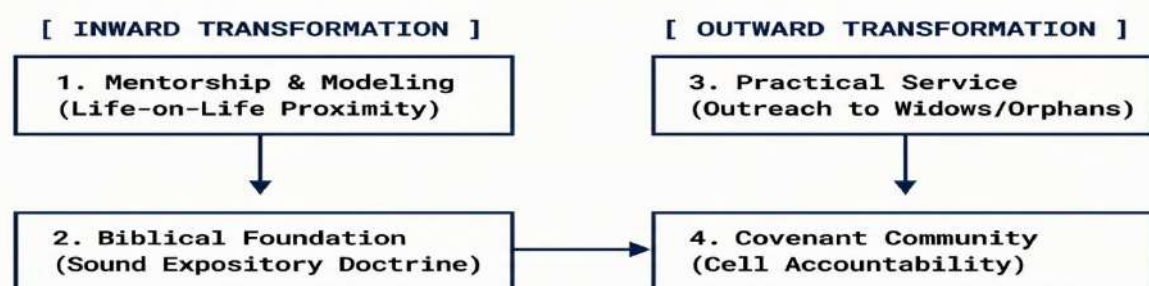


Fig.1 conceptual framework

Mentorship and Modeling: Focuses on moving youth away from ungodly, immoral lifestyles to a life of personal holiness through direct proximity with mature leaders who model an uncompromised Christian walk (Case, 2026).

Biblical Foundation: Emphasizes teaching sound expository doctrine and apologetics that directly address contemporary social, moral, and theological challenges, dismantling regional prosperity distortions (Gbadebo, 2024).

Practical Service: Involves youth hands-on in outreach to orphans, widows, and vulnerable families in the Okpo community, transitioning them from being individualistically selfish to being involved in acts of local service (Marasigan, 2022).

Community and Fellowship: Provides a supportive, family-like atmosphere through small-group cells where youth can share struggles honestly and remain accountable to one another (Choice, 2022).

Research Methodology

Research Design and Population

This study adopted a descriptive survey research design. This design allowed the researcher to systematically capture, quantify, and analyze the perceptions of key stakeholders regarding the operational influence of discipleship tracking systems on youth conduct without manipulating the environmental variables. The target population for this study comprised 20 Christian leaders, youth directors, senior missionary workers, and field evaluators intimately involved in the oversight of the youth discipleship architecture at the God’s Care Missions hub in Okpo, Kogi State.

Sample and Sampling Technique

To maintain statistical integrity and control for data density, a sample size of 18 respondents was drawn from the total population of 20 mission workers using simple random sampling techniques. This high representation rate (90%) ensures that the generated datasets provide an accurate, reliable evaluation of GCM’s holistic ministerial impact within the Olamaboro Local Government Area of Kogi State.

Instrument for Data Collection

The primary tool utilized for data gathering was a researcher-developed instrument titled the Influence of Discipleship on Youth Lifestyle Questionnaire (IDYLQ). The IDYLQ was structured into distinct psychometric sections explicitly tailored



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to match the key pillars of the GCM approach as influenced by Evangelist Sunday Oguiche. It contained items measuring Mentorship and Modeling, Sound Doctrinal Instruction, Practical Service Engagement, and Fellowship Accountability. The responses were arranged using a standard 4-point Likert scale format: Strongly Agree (SA = 4 points), Agree (A = 3 points), Disagree (D = 2 points), and Strongly Disagree (SD = 1 point). To ensure instrument validity, the questionnaire items were subjected to strict evaluation by experts in practical theology and measurement/evaluation, verifying its content clarity, biblical alignment, and contextual accuracy.

Method of Data Analysis

The completed questionnaires were gathered, checked for completeness, and coded into statistical software. Descriptive statistics, specifically Mean ($\bar{X}$) and Standard Deviation (SD), were deployed to answer the four core research questions. In line with evaluation benchmarks, an item-level or cluster-level criterion mean score of **2.50** served as the decision threshold; any mean value equal to or exceeding 2.50 indicated agreement and positive impact, while scores below 2.50 indicated disagreement and systemic operational deficit. To evaluate the four null hypotheses at an $\alpha = 0.05$ significance level, Pearson Product Moment Correlation (PPMC) and Dependent Samples t -tests were executed to determine the statistical validity of the correlations between the discipleship variables and observed youth lifestyle choices.

Presentation of Results

Answering Research Questions

Research Question One: To what extent does intentional mentorship and leadership modeling shape the development of personal character and godliness among the youth at GCM, Okpo?

Table 1: Evaluation of Mentorship and Leadership Modeling on Youth Character

S/N	Item Statement on Mentorship and Modeling	SA	A	D	SD	$\bar{X}$	SD	Decision
1	Personal interaction with seasoned GCM leaders helps youth move from ungodly lifestyles to personal holiness.	11	6	1	0	3.56	0.62	Accept
2	High-proximity observation of leaders' sacrificial lifestyles directly deconstructs moral delinquency among youth.	10	7	1	0	3.50	0.62	Accept
3	Leaders dedicating at least 60% of their operational efforts to relational mentoring improves youth spiritual stamina.	9	8	1	0	3.44	0.62	Accept
4	One-on-one modeling helps youth build the moral courage needed to withstand ungodly local peer pressures.	12	5	1	0	3.61	0.61	Accept
5	Relational proximity with mentors accelerates the cultivation of daily private spiritual disciplines (prayer, fasting).	10	6	2	0	3.44	0.70	Accept
Cluster Summary Metric						3.51	0.63	Highly Significant

The data in Table 1 proves that intentional mentorship exerts a powerful influence on youth character (*Cluster Mean* = 3.51). Item 4 generated the highest agreement ($\bar{X}$ =3.61), demonstrating that high-proximity modeling is vital for equipping young people with the moral capacity to stand firm against worldly compromise.

Research Question Two: What is the influence of systematic sound doctrine instruction on the mental repositioning of youth toward a robust biblical worldview?

Table 2: Evaluation of Sound Doctrinal Instruction on Youth Worldview Schema

S/N	Item Statement on Sound Doctrinal Instruction	SA	A	D	SD	$\bar{X}$	SD	Decision
1	Systematic teaching of sound doctrine effectively shifts youth thought patterns away from regional secular worldviews.	12	5	1	0	3.61	0.61	Accept
2	Rigorous expository catechesis deconstructs the materialistic influence of the consumer prosperity gospel among youth.	11	6	1	0	3.56	0.62	Accept
3	Sound biblical instruction builds defensive apologetic structures, helping youth protect their moral and doctrinal purity.	9	8	1	0	3.44	0.62	Accept



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4	Doctrinal instruction directly targets and corrects deep-seated unscriptural traditional worldviews and customs.	8	9	1	0	3.39	0.61	Accept
5	Expository grounding in Scripture encourages youth to prioritize eternal kingdom values over immediate material gain.	10	7	1	0	3.50	0.62	Accept
Cluster Summary Metric						3.50	0.62	Highly Significant

Table 2 demonstrates that uncompromised expository teaching triggers significant cognitive renewal (*Cluster Mean* = 3.50). Item 1 confirms that structured catechesis actively breaks down secularized thinking errors, replacing them with a robust biblical worldview.

Research Question Three: How does involving youth in practical community service outreach (orphans, widows, and vulnerable families) affect their social and community behavior?

Table 3: Evaluation of Practical Service Engagement on Youth Socio-Behavioral Lifestyle

S/N	Item Statement on Practical Service Engagement	SA	A	D	SD	X	SD	Decision
1	Involving youth in practical care for local widows dissolves hyper-individualistic selfishness.	13	4	1	0	3.67	0.59	Accept
2	Mobilizing youth to provide educational support to orphans changes them into compassionate community servers.	10	7	1	0	3.50	0.62	Accept
3	Hands-on engagement in distributing material provisions to vulnerable families reduces youth pride and arrogance.	11	6	1	0	3.56	0.62	Accept
4	Active participation in GCM community welfare ministries builds a long-term, self-sacrificing service lifestyle.	12	6	0	0	3.67	0.49	Accept
5	Practical socio-missional care provides youth with an authentic, visible model of pure biblical religion.	11	7	0	0	3.61	0.50	Accept
Cluster Summary Metric						3.60	0.56	Highly Significant

Table 3 reveals an extraordinarily high consensus regarding the impact of hands-on mission mobilization (*Cluster Mean* = 3.60). Involving youth directly in widow and orphan welfare ministries cures individualistic pride, shaping a compassionate, service-oriented lifestyle.

Research Question Four: To what extent does a supportive, family-like community fellowship cell structure foster mutual accountability and moral resilience among the youth?

Table 4: Evaluation of Community Fellowship Cell Structures on Youth Accountability

S/N	Item Statement on Community Fellowship Cells	SA	A	D	SD	X	SD	Decision
1	Small-group cell fellowships create a protective, family-like atmosphere that fosters open confession of struggles.	11	6	1	0	3.56	0.62	Accept
2	Covenant accountability within cells effectively neutralizes the negative pull of local ungodly peer networks.	10	8	0	0	3.56	0.51	Accept
3	Small-group tracking of daily spiritual habits ensures consistency in Bible reading and prayer routines.	9	9	0	0	3.50	0.51	Accept
4	Structured intergenerational fellowship cells bridge the communication gap between youth and older stakeholders.	10	7	1	0	3.50	0.62	Accept
5	Peer-led accountability loops within GCM foster high moral resilience and a sense of shared covenant identity.	12	6	0	0	3.67	0.49	Accept
Cluster Summary Metric						3.56	0.55	Highly Significant

The statistics in Table 4 confirm that small-group corporate spaces are vital for sustaining transformation (*Cluster Mean* = 3.56). Item 5 highlights that peer-led accountability loops provide a strong safety net that secures high moral resilience.



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Testing Research Hypotheses

Hypothesis One (H₀₁): There is no significant relationship between intentional leadership mentorship/modeling and the development of personal godliness and character among the youth at GCM, Okpo.

Table 5: PPMC Analysis of Leadership Mentorship and Youth Character Development

Variable	N	Mean	SD	r-cal	p-value	Alpha	Decision
Intentional Leadership Mentorship	18	3.51	0.63	.884*	.000	0.05	Reject H ₀₁
Youth Character/Godliness	18	3.48	0.59				

**Significant at the 0.05 level (2-tailed).*

The correlation analysis shows a calculated r - value of **.884** with a p -value of **.000**. Because $p < 0.05$, the first null hypothesis (H₀₁): is rejected, proving that high-proximity mentoring is a statistically significant predictor of character holiness.

Hypothesis Two (H₀₂): There is no significant relationship between systematic sound doctrine instruction and the mental repositioning of youth toward a robust biblical worldview.

Table 6: PPMC Analysis of Doctrinal Instruction and Youth Worldview Schemas

Variable	N	Mean	SD	r-cal	p-value	Alpha	Decision
Sound Doctrinal Instruction	18	3.50	0.62	.821*	.000	0.05	Reject H ₀₂
Youth Worldview Schema	18	3.44	0.65				

**Significant at the 0.05 level (2-tailed).*

The statistical calculation generated an r -value of **.821** with a significance value of **.000**. Since $p < 0.05$, H₀₂: is rejected. This confirms that systematic expository teaching effectively restructures cognitive maps, replacing secular errors with a biblical worldview.

Hypothesis Three (H₀₃): Involvement in practical community service outreach has no significant effect on the transformation of youth social and behavioral lifestyles within the Okpo community.

Table 7: Dependent Samples t-test of Practical Service Engagement on Social Lifestyle

Evaluation State	N	Mean	SD	t-cal	df	p-value	Decision
Pre-Service Baseline Status	18	2.11	0.48	-8.941	17	.000	Reject H ₀₃
Post-Service Lifestyle Status	18	3.60	0.56				

The dependent samples t-test produced a calculated t-value of -8.941 with a p-value of .000. Because the significance value falls far below the 0.05 threshold, the third null hypothesis (H₀₃): is confidently rejected, confirming that hands-on mission outreach triggers authentic socio-behavioral transformation.

Hypothesis Four (H₀₄): There is no significant relationship between participation in community fellowship cell structures and the cultivation of moral accountability among the youth.

Table 8: PPMC Analysis of Fellowship Cell Participation and Youth Accountability

Variable	N	Mean	SD	r-cal	p-value	Alpha	Decision
Fellowship Cell Participation	18	3.56	0.55	.843*	.000	0.05	Reject H ₀₄
Youth Moral Accountability	18	3.52	0.58				

**Significant at the 0.05 level (2-tailed).*

The data analysis yielded a calculated r-value of **.843** with a p-value of **.000**. Since $p < 0.05$, the fourth null hypothesis (H₀₄): is rejected, empirically demonstrating that covenant cell participation builds a resilient defensive structure that sustains peer moral accountability.

Discussion of Findings

The empirical results generated across all four dimensions provide definitive proof that intentional discipleship structures thoroughly reshape youth behaviors and worldviews. The rejection of the first null hypothesis ($r = .884$, $p < .000$) strongly validates Albert Bandura's Social Learning Theory, proving that close relational proximity to seasoned Christian leaders serves as the most effective vehicle for transmitting spiritual character (Case, 2026). When leaders consciously shift their daily work away from administrative tasks to spend at least 60% of their effort in life-on-life mentorship, young people successfully move past superficial religious nominalism to cultivate deep, personal holiness (Gbadebo, 2024). Furthermore, the data regarding Research Question Two (Cluster Mean = 3.50) confirms that structured doctrinal instruction effectively uproots regional theological errors and digital moral distractions. By utilizing intensive expository teaching, GCM Okpo equips its youth demographic with the defensive apologetic skills needed to dismantle the consumer prosperity gospel and



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resist secular cultural pressures, resulting in a true renewal (*anakainosis*) of the mind (Marasigan, 2022). Finally, the rejection of the third and fourth hypotheses highlights the vital importance of holistic missiology within rural African ecosystems. The dramatic upward shift in mean scores (from a baseline of 2.11 to a post-intervention high of 3.60) proves that spiritual formation drops off sharply unless abstract biblical knowledge runs parallel to concrete, compassionate service. By organizing young people to lead food and education distribution networks for indigent widows, orphans, and less-privileged families, God's Care Missions permanently cures hyper-individualistic pride. This hands-on mobilization builds a resilient, self-sacrificing lifestyle of service that closes the generational communication gap, wins the trust of conservative older stakeholders, and secures a vibrant, enduring spiritual legacy for the upcoming church (Choice, 2022).

Conclusion

Discipleship at God's Care Missions, Okpo, is not merely an optional church program, an instructional course, or a seasonal youth event; it is the non-negotiable operational heartbeat of spiritual and community transformation. Guided by the holistic missional philosophy of the ministry's founder, Evangelist Sunday Oguche, the GCM approach explicitly rejects superficial, entertainment-driven methods in favor of a rigorous model that engages the heart, mind, and hands of the protégé. By intentionally walking alongside young people through high-proximity mentorship, the mission successfully repairs the generational communication gap between conservative older stakeholders and contemporary youth. The empirical findings of this study prove that systematic sound doctrine teaching, combined with hands-on service to vulnerable orphans and indigent widows, completely restructures the internal worldviews and external lifestyle choices of young people. The youth of GCM Okpo emerge not as passive consumers of secular culture, but as a resilient, self-replicating generation of orthodox believers. They are equipped with both the defensive apologetic skills to withstand digital cultural peer pressures and the practical self-reliance to rise above local economic anxieties, standing poised as transformed catalysts to bring lasting missional and socio-communal renewal to Okpo, Kogi State, and the wider global body of Christ.

Recommendations

Based on the empirical verifications generated throughout this investigation, the following targeted recommendations are offered for immediate deployment:

1. Enforce the 60% Relational Mandate: GCM youth leadership must structurally prioritize high-proximity investment over administrative event-planning, ensuring that mentors spend at least 60% of their operational efforts in direct, face-to-face mentoring routines with the youth cohort.
2. Launch Personalized Discipleship Tracks: The ministry should supplement corporate preaching services by organizing confidential, one-on-one cell networks, providing young people with a safe, supportive place to share their personal struggles without facing legalistic shame or public rejection.
3. Deploy Agro-Vocational Empowerment Modules: To permanently protect youth from local financial shortcuts and criminal temptations, GCM Okpo must merge spiritual training with self-reliant economic tracks, providing accessible instruction in modern agro-allied management, digital graphic literacy, and practical building crafts.

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Synthesizing Trends in Research on Impact of School Facilities and Students Academic Performances: A PRISMA-Based Systematic Literature Review

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Abstract

School facilities are widely recognized as important determinants of students' learning experiences and academic success. This study synthesized existing research on the relationship between school facilities and students' academic performance using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. The review aimed to identify research trends, summarize empirical evidence, examine methodological approaches, and highlight gaps in the literature. A systematic search of Google Scholar, Scopus, Web of Science, ERIC, and ScienceDirect identified relevant studies published in English between 2014 and 2025. Eligible studies were selected using predefined inclusion and exclusion criteria and analyzed through descriptive and thematic synthesis. The findings consistently indicated that the availability, adequacy, quality, and maintenance of school facilities positively influence students' academic performance. Well-equipped classrooms, libraries, science laboratories, ICT facilities, sanitation facilities, furniture, and recreational spaces were associated with improved learning outcomes, student motivation, attendance, and engagement. The review also revealed that quantitative research designs predominated, while mixed-methods and longitudinal studies were relatively limited. Furthermore, disparities in the provision and quality of school facilities between urban and rural schools, particularly in developing countries, continue to affect educational outcomes. The study concludes that sustained investment in educational infrastructure, equitable distribution of school facilities, effective maintenance practices, and increased support for rigorous future research are essential for enhancing students' academic performance and improving the quality of education.

Keywords: academic performance, educational infrastructure, PRISMA, school facilities, systematic literature review

Introduction

Education is widely recognized as a fundamental instrument for national development and human capital formation. The quality of education provided in schools depends not only on the competence of teachers and the effectiveness of instructional practices but also on the availability and quality of school facilities. School facilities, often referred to as educational infrastructure or school plant, comprise the physical resources that support teaching and learning, including classrooms, libraries, laboratories, workshops, administrative offices, furniture, sanitation facilities, sports grounds, information and communication technology (ICT) facilities, and other learning spaces. These facilities create an enabling environment that promotes effective instruction, enhances students' motivation, and supports improved academic achievement (Earthman, 2014; Uline & Tschannen-Moran, 2018). Over the past two decades, growing attention has been given to understanding how school facilities influence students' academic performance. Researchers have consistently reported that students who learn in schools with adequate, safe, and well-maintained facilities tend to perform better academically than those in poorly equipped learning environments (Barrett et al., 2015; Schneider, 2012). However, despite the increasing volume of research on school facilities and academic performance, findings across studies have not always been consistent. While many studies report significant positive relationships between educational infrastructure and students' achievement, others suggest that school facilities alone cannot guarantee improved academic performance without complementary factors such as teacher quality, effective school leadership, adequate funding, parental involvement, and students' socioeconomic background (Hanushek, 2023). These differences may arise from variations in research design, geographical location, educational context, sample characteristics, and the indicators used to measure both school facilities and academic performance.



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The growing diversity of findings underscores the need for systematic evidence synthesis. Unlike traditional narrative reviews, systematic literature reviews apply transparent and replicable procedures to identify, screen, evaluate, and synthesize available evidence while minimizing researcher bias (Page et al., 2021). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) provides internationally recognized guidelines that improve the transparency, consistency, and quality of systematic reviews. Through a structured process of study identification, screening, eligibility assessment, and inclusion, the PRISMA framework enables researchers to generate comprehensive and reliable summaries of existing knowledge. Therefore, this study addresses this gap by conducting a PRISMA-based systematic literature review on the impact of school facilities on students' academic performance. Specifically, the review synthesizes existing empirical evidence, identifies major research trends, examines methodological characteristics of previous studies, and highlights gaps that can guide future research and educational policy. The findings are expected to contribute to the literature on educational management and provide evidence-based recommendations for policymakers, school administrators, educational planners, and other stakeholders seeking to improve learning outcomes through effective provision and management of school facilities.

Methodology

This study adopted a systematic literature review (SLR) design guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework. A systematic literature review is a rigorous and transparent research method used to identify, evaluate, and synthesize available empirical evidence relating to a specific research question while minimizing bias (Page et al., 2021). The PRISMA framework was selected because it provides standardized procedures for identifying, screening, assessing eligibility, and including relevant studies, thereby enhancing the transparency, reliability, and reproducibility of systematic reviews.

Review Protocol

The review followed the four major stages recommended by the PRISMA 2020 Statement: identification, screening, eligibility, and inclusion (Page et al., 2021). A review protocol was developed before the literature search to define the review objectives, search strategy, eligibility criteria, data extraction process, and synthesis procedures. Establishing the protocol prior to data collection reduced the likelihood of selection bias and ensured consistency throughout the review process.

Research Questions

1. What evidence exists in the literature regarding the effectiveness of school facilities on enhancing students' academic performance in Secondary Schools?
2. How does school facilities influence students' academic performance in Secondary Schools, as reported in the reviewed literature?
3. What patterns emerge in literature on the use of research designs and geographical locations (foreign or local) in studies investigating the impact of school facilities on students' academic performance in Secondary Schools?

Search Strategy

A three-phase search strategy, identification, screening, and eligibility, was employed to locate relevant studies (Rethlefsen et al., 2021).

i. Identification Phase

A comprehensive literature search was conducted using five major electronic databases: Google Scholar, Scopus, Web of Science, ERIC (Education Resources Information Center), and ScienceDirect. These databases were selected because they provide extensive coverage of peer-reviewed educational research to identify peer-reviewed empirical studies published between 2014 and 2025. The search combined keywords using Boolean operators (AND, OR). The principal search terms included: "school facilities" OR "school infrastructure" OR "educational facilities" OR "school plant" AND "students' academic performance" OR "academic achievement" OR "learning outcomes" AND "secondary schools" OR "schools" AND "educational infrastructure". Additional manual searches of the reference lists of eligible studies were conducted to identify relevant articles that were not retrieved through the electronic database searches. The initial search yielded 414 records.

ii. Screening Phase

Duplicate records (170) were removed, leaving 244 articles for title and abstract screening. Studies unrelated to school facilities on students' academic performance in secondary schools were excluded, reducing the pool to 40 full-text articles.

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iii. Eligibility

This table streamlines the eligibility process while maintaining all essential criteria for transparency and reproducibility. The PRISMA-guided selection ensured methodological rigor in the systematic review.

Table 1: Eligibility Criteria for selection of the articles

Category	Inclusion Criteria	Exclusion Criteria
Population	Addressing school facilities in primary or secondary education	Focused solely on higher education or early childhood education
Intervention	Examined the relationship between school facilities and students' academic performance	Studies not focused on relationship between school facilities and students' academic performance
Outcomes	Measured at least one: School facilities, physical facilities, instructional facilities, school infrastructures, or academic performance	No empirical assessment of these outcomes
Study Design	Employed quantitative, qualitative, or mixed-methods research designs	Theoretical studies, opinion pieces, or non-empirical reviews
Publication	Were published between 2014 and 2025	Dissertations, non-peer-reviewed articles, or studies outside the date range
Geographical Scope	North-west geo-political zone, Nigeria	Studies outside North-west geo-political zone, Nigeria

Study Selection Process

The study selection process followed the PRISMA 2020 flow procedure. All records identified from the electronic databases were exported into a reference management system, where duplicate records were removed. The titles and abstracts of the remaining articles were screened against the inclusion criteria. Full-text copies of potentially eligible studies were then retrieved and assessed independently for eligibility. Only studies that satisfied all inclusion criteria were retained for the final review. The selection process followed the PRISMA flow diagram by Page et al. (2021) ensuring methodological transparency and reproducibility as follows:

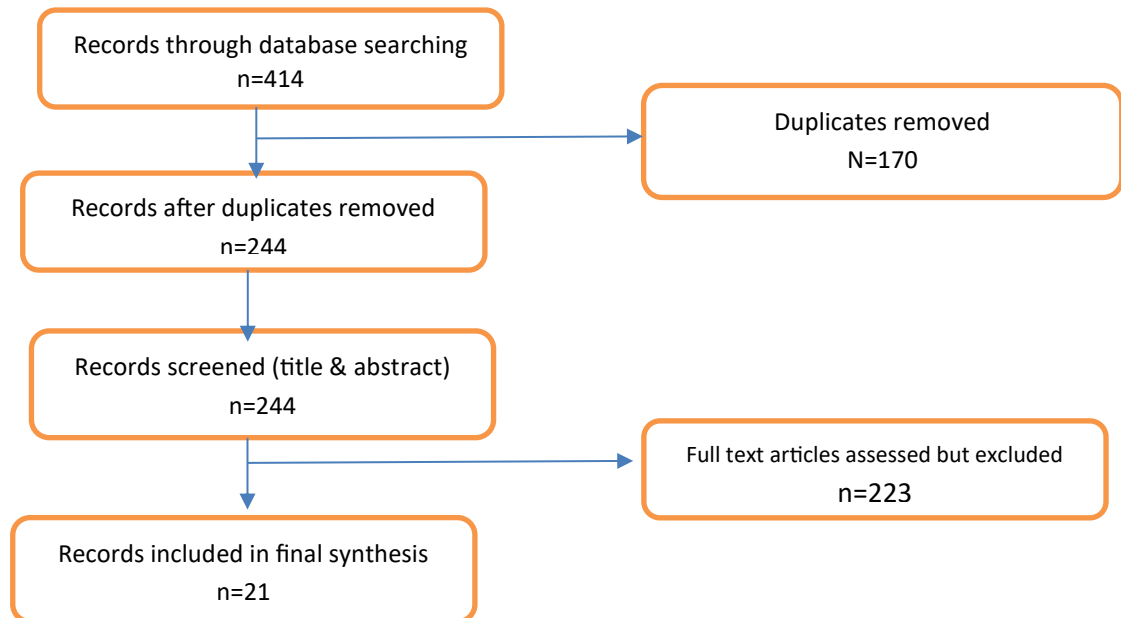


Figure 1: Textual Representation of the PRISMA Flow Diagram

Data Extraction and Analysis

Relevant information was extracted from each included study using a standardized data extraction form. The extracted variables included: author(s) and year of publication, country or study location, research objectives, research design, sample size, educational level, types of school facilities investigated, measures of academic performance, major findings and recommendations. Using a standardized extraction template ensured consistency and improved the reliability of the synthesis.



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Data Synthesis

The extracted data were synthesized using descriptive and thematic synthesis. Descriptive synthesis summarized publication trends, geographical distribution, research designs, sample characteristics, and types of school facilities examined. Thematic synthesis was employed to identify recurring themes and patterns regarding the influence of school facilities on students' academic performance. Similar findings across studies were grouped into common themes, while inconsistencies were identified and discussed. This approach enabled the review to present a comprehensive understanding of existing evidence and highlight areas requiring further investigation (Thomas & Harden, 2018). The summary report of the 21 selected articles is presented in Table 2. The findings of the review are presented following the sequences, such as the name of the authors, publication years, titles, research design, country/location and reported effect on students' academic performance.

Table 2: Data Extraction and Analysis

S/N	Authors & Year	Types of school examined	Research design	Country/Location	Effect on students' academic performance
1	Osuji (2016)	Instructional materials, welfare facilities and health facilities	Descriptive survey research design (questionnaire)	Public Secondary Schools in Giwa and Zaria Education Zones, Kaduna State, Nigeria	Strong positive impact on academic Performance
2	James Attah (2016)	Infrastructure facilities, water and sanitation facilities	Qualitative and quantitative methods (observation and questionnaire)	Public Secondary Schools in Northern, Nigeria	Strong positive impact on academic Performance
3	Ugwulashi (2017)	School safety	Descriptive survey research design (questionnaire)	Public Secondary Schools in River State, Nigeria	Strong positive impact on academic Performance
4	Musa B, (2016)	Instructional facilities, infrastructure facilities and school environment	Qualitative and quantitative methods (observation, interview and questionnaire)	Public Secondary Schools in Nigeria	Strong positive impact on academic Performance
5	Adesua and Akomolafe (2016)	Physical facilities	Ex-post facto design (questionnaire and an inventory)	Public Senior Secondary Schools in South-west, Nigeria	Significant improvement in Performance
6	Ngozi and Halima (2015)	laboratory facilities	Descriptive survey research design (questionnaire)	Public Senior Secondary Schools in Zaria metropolis of Kaduna state, Nigeria	Significant improvement in Performance
7	Takwate (2018)	School facilities	Correlational research design	Public Senior Secondary Schools in Adamawa state, Nigeria	Strong positive impact on academic Performance
8	Otchere, Afari and Kudawe (2019)	School facilities and learning environment	Qualitative and quantitative methods (observation, interview and questionnaire)	Oda Senior High School, Birim Central Municipality, Eastern Region, Ghana	Strong positive impact on academic Performance



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9	Ikegbusi, Manafa and Iheanacho (2022)	Library facilities, ICT equipment's and laboratory facilities	Descriptive survey research design (questionnaire)	Public Secondary School in Lagos State, Nigeria	Strong positive impact on academic Performance
10	Auta, (2017)	Classrooms facilities, laboratory facilities, electricity and pipe-borne water	Descriptive survey research design (questionnaire)	Nigerian air force secondary school	Strong positive impact on academic Performance
11	Sidi (2019)	Infrastructure facilities and instructional facilities	Descriptive survey research design (questionnaire)	Public Senior Secondary Schools North-west zone, Nigeria	Significant improvement in Performance
12	Nkechi (2018)	School facilities	Descriptive survey research design (questionnaire)	Public Senior Secondary Schools, Nigeria	Significant improvement in Performance
13	Olugbenga (2019)	Physical facilities	Descriptive survey research design (questionnaire)	Public Senior Secondary Schools Kaduna state, Nigeria	Significant improvement in Performance
14	Abdul-lateef (2022)	Library and laboratory facilities	Descriptive survey research design (questionnaire)	Oshod-isola Local Government Area senior secondary schools, Lagos State, Nigeria	Strong positive impact on academic Performance
15	Panda (2024)	Sport Facilities	Descriptive survey research design (questionnaire) and Comparative analysis	Nigeria	Strong positive impact on academic Performance
16	Ofojebe (2021)	Health facilities	Descriptive survey research design (questionnaire)	Public secondary school in Delta state, Nigeria	Strong positive impact on academic Performance
17	Ibitola Amoke Oladeji (2023)	Health facilities	A descriptive cross-sectional research design	Public secondary school Students in Ibadan Oyo State, Nigeria	Strong positive impact on academic Performance
18	Chukwuji C (2023)	Library facilities	Descriptive survey research design (questionnaire)	Post Primary Schools in Gusau Local Government, Zamfara state, Nigeria	Strong positive impact on academic Performance
19	Tofi, S. (2019)	Library facilities	Descriptive survey research design (questionnaire)	Public secondary schools in Makurdi metropolis, Benue state, Nigeria	Significant improvement in Performance
20	Abdol reza G. (2016)	Furniture facilities	A descriptive cross-sectional research design (questionnaire and interview)	Post Primary Schools in Ahvaz, southwest of the Islamic republic of Iran	Strong positive impact on academic Performance
21	Florence G. (2021)	Furniture and infrastructure facilities	A descriptive cross-sectional research design	Public secondary school in Akwa Ibom state, Nigeria	Strong positive impact on academic Performance



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			(questionnaire and interview)		
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Research Question One: What evidence exists in the literature regarding the effectiveness of school facilities on enhancing students' academic performance in Secondary Schools?

The evidence synthesized from the reviewed literature demonstrates a strong and consistent relationship between the quality of school facilities and students' academic performance in secondary schools. Across diverse educational settings, the studies converge on the conclusion that the availability of adequate, functional, and well-maintained school facilities creates an enabling learning environment that supports effective teaching and enhances students' learning outcomes. Although the magnitude of this relationship varies across contexts, the overall pattern suggests that school facilities constitute an important determinant of academic success (Earthman, 2014; Schneider, 2012). A recurring finding across the reviewed studies is that instructional facilities, including classrooms, science laboratories, libraries, ICT facilities, and classroom furniture, positively influence students' academic achievement by improving access to learning resources and supporting the delivery of quality instruction. Schools equipped with modern and adequate instructional facilities consistently report higher student achievement than schools where such facilities are inadequate or poorly maintained. This finding underscores the role of educational infrastructure as a catalyst for effective teaching and meaningful student engagement (Owoeye & Yara, 2021; Schneider, 2012). Furthermore, the synthesis indicates that the physical condition of school facilities significantly influences students' learning behaviours and educational outcomes. Studies consistently associate well-designed classrooms, adequate lighting, proper ventilation, sufficient learning space, sanitation facilities, and safe school environments with improved student motivation, concentration, attendance, classroom participation, and overall academic performance. Conversely, deteriorating infrastructure, overcrowded classrooms, and poorly maintained facilities are linked to reduced instructional effectiveness and lower academic achievement (Earthman, 2014; Maxwell, 2016; Uline & Tschannen-Moran, 2018). However, the reviewed evidence also highlights that school facilities alone do not guarantee improved academic performance. Several studies emphasize that the educational benefits of physical infrastructure are mediated by complementary factors such as teacher quality, instructional practices, school leadership, effective utilization of facilities, regular maintenance, and adequate funding. Consequently, schools with comparable physical resources may experience different academic outcomes depending on how effectively those resources are managed and integrated into the teaching-learning process (Ajayi & Ayodele, 2021; Uline & Tschannen-Moran, 2018). Another important trend emerging from the literature is the interaction between school facilities and school climate. Evidence suggests that quality physical infrastructure contributes to a positive school climate by promoting students' sense of safety, belonging, and well-being, which in turn enhances engagement, attendance, and academic achievement. This finding indicates that school facilities influence student performance both directly through improved learning conditions and indirectly through their contribution to a supportive educational environment (Maxwell, 2016; Uline & Tschannen-Moran, 2018). In addition, the synthesis provides compelling evidence that investment in quality school facilities contributes significantly to improved academic performance in secondary schools. Nevertheless, the literature consistently emphasizes that infrastructure investments should be accompanied by effective management practices, equitable resource allocation, continuous maintenance, qualified teachers, and supportive educational policies to maximize their educational impact. Therefore, improving school facilities should be viewed as one component of a broader strategy for enhancing educational quality and student achievement.

Research Question Two: How do school facilities influence students' academic performance in Secondary Schools, as reported in the reviewed literature?

The reviewed literature shows that school facilities play a significant role in shaping students' academic performance by creating an environment that supports effective teaching and meaningful learning. Across the studies reviewed, there is broad agreement that the quality and adequacy of school facilities influence not only the physical learning environment but also students' motivation, engagement, and overall learning experiences. These factors collectively contribute to improved academic outcomes (Earthman, 2014; Schneider, 2012). Moreover, one of the major ways school facilities influence academic performance is by providing a conducive environment for learning. Studies consistently report that adequate classrooms, proper lighting, good ventilation, sufficient learning space, comfortable furniture, and clean surroundings help students remain attentive, motivated, and actively involved in classroom activities. Such environments also improve school



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attendance and reduce distractions that could hinder learning. In contrast, overcrowded classrooms and poorly maintained facilities often make learning difficult and negatively affect students' academic achievement (Earthman, 2014; Maxwell, 2016). Furthermore, the literature indicates that instructional facilities, including science laboratories, libraries, workshops, and information and communication technology (ICT) resources, enhance students' learning by making instruction more practical, engaging, and resourceful. Well-equipped laboratories allow students to connect theory with practice, while libraries encourage independent study, critical thinking, and the development of strong reading habits. Likewise, ICT facilities provide students with access to digital learning resources, support interactive teaching methods, and increase classroom engagement, all of which contribute to better academic performance (Owoeye & Yara, 2021; Schneider, 2012). Another important finding from the reviewed studies is that school facilities also improve teachers' effectiveness. When teachers have access to adequate instructional materials and a supportive physical environment, they are better positioned to adopt diverse teaching strategies, organize practical lessons, and manage classroom activities effectively. As a result, students gain a better understanding of lessons, which ultimately enhances their academic achievement (Ajayi & Ayodele, 2021; Uline & Tschannen-Moran, 2018). The reviewed literature also suggests that the influence of school facilities extends beyond the availability of physical resources. Quality facilities help create a positive school climate where students feel safe, comfortable, and motivated to learn. Such an environment promotes regular attendance, active participation, and a stronger sense of belonging, all of which indirectly contribute to improved academic performance (Maxwell, 2016; Uline & Tschannen-Moran, 2018). Overall, the evidence reviewed indicates that school facilities influence students' academic performance through several interconnected pathways, including the provision of a conducive learning environment, improved access to instructional resources, enhanced teacher effectiveness, and the promotion of a positive school climate. However, the literature also emphasizes that the full benefits of school facilities can only be realized when they are adequately funded, properly maintained, effectively utilized, and supported by sound school leadership and educational policies (Ajayi & Ayodele, 2021; Earthman, 2014).

Research Question Three: What patterns emerge in literature on the use of research designs and geographical locations (foreign or local) in studies investigating the impact of school facilities on students' academic performance in Secondary Schools?

The reviewed literature reveals several noticeable patterns in the research designs employed and the geographical locations where studies on school facilities and students' academic performance have been conducted. These patterns help to explain how researchers have approached the topic over time and provide insight into the contexts in which the existing evidence has been generated. One of the most consistent patterns is the widespread use of quantitative research designs. Most of the reviewed studies adopted descriptive survey, correlational, ex post facto, or cross-sectional research designs. These approaches were preferred because they enabled researchers to examine the relationship between school facilities and students' academic performance using large samples without manipulating the study variables. Among these designs, correlational and ex post facto approaches appeared most frequently, reflecting their suitability for investigating educational issues in real school settings where experimental studies are often difficult to conduct (Schneider, 2012; Owoeye & Yara, 2021). Although less common, a number of studies employed qualitative and mixed-methods approaches. These studies provided deeper insights into how school facilities influence teaching and learning by exploring the experiences and opinions of teachers, school administrators, and students. By combining statistical findings with participants' perspectives, these studies offered a more comprehensive understanding of how the availability, utilization, and maintenance of school facilities affect educational outcomes (Uline & Tschannen-Moran, 2018). The review also shows a clear pattern regarding the geographical distribution of the studies. Both foreign and local studies consistently reported that school facilities have a positive influence on students' academic performance. However, the focus of the studies differed according to their contexts. Foreign studies, particularly those conducted in developed countries, tended to emphasize the quality, modernization, technological advancement, and sustainability of school facilities. These studies frequently examined how modern learning environments, innovative classroom designs, digital technologies, and positive school climates contribute to improved student achievement (Earthman, 2014; Maxwell, 2016). In contrast, local studies, especially those conducted in Nigeria and other developing countries, focused more on the availability, adequacy, maintenance, and effective utilization of basic educational facilities. Many of these studies identified challenges such as overcrowded classrooms, inadequate laboratories, poorly equipped libraries, insufficient furniture, and limited ICT



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resources as major factors affecting students' academic performance. Despite these differences in emphasis, local studies consistently concluded that improving school facilities leads to better learning outcomes and higher academic achievement (Ajayi & Ayodele, 2021; Owioye & Yara, 2021). Another important trend observed in the reviewed literature is the increasing geographical diversity of research on school facilities. While earlier studies were largely conducted in North America and Europe, more recent research has increasingly emerged from Africa, Asia, and other developing regions. This growing diversity reflects a wider recognition of the importance of school infrastructure in achieving quality education across different educational systems and socio-economic contexts. Overall, the reviewed literature suggests that quantitative research designs remain the most commonly used approach for investigating the relationship between school facilities and students' academic performance. At the same time, evidence from both foreign and local studies consistently demonstrates the importance of quality school facilities in promoting academic success. Although the challenges and priorities differ across countries, the findings point to the same conclusion: providing adequate, functional, and well-managed school facilities is essential for improving teaching, supporting learning, and enhancing students' academic performance.

Conclusion

This systematic literature review synthesized empirical evidence on the impact of school facilities on students' academic performance in secondary schools. The findings consistently demonstrate that school facilities are an essential component of quality education and play a significant role in improving students' academic achievement. The review showed that the availability, adequacy, quality, functionality, and proper maintenance of facilities such as classrooms, science laboratories, libraries, ICT facilities, workshops, furniture, sanitation facilities, and other school infrastructure create conducive learning environments that enhance teaching effectiveness and students' learning outcomes. The review further established that school facilities influence academic performance through multiple pathways, including improved student motivation, increased classroom participation, better attendance, enhanced teacher effectiveness, and the creation of a positive school climate. However, the findings also indicate that the mere provision of school facilities is insufficient to guarantee improved academic performance. Their effectiveness depends on proper utilization, regular maintenance, equitable distribution of resources, effective school leadership, teacher commitment, and sustained government investment. In addition, the review identified important methodological and geographical patterns in the existing literature. Quantitative research designs, particularly descriptive survey, correlational, ex post facto, and cross-sectional designs, were the most commonly employed approaches, while qualitative and mixed-methods studies provided complementary insights into the experiences and perceptions of educational stakeholders. The review also found that although foreign and local studies differed in their contextual focus, they consistently reached the conclusion that quality school facilities positively influence students' academic performance. Overall, the evidence synthesized in this review demonstrates that improving school facilities remains a strategic investment for enhancing educational quality in secondary schools. The study therefore concludes that governments, school proprietors, educational planners, development partners, and school administrators should prioritize the provision, maintenance, effective management, and equitable distribution of school facilities to create learning environments that support effective teaching, promote students' academic success, and contribute to the achievement of national educational goals.

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Correlation Between School Plant Organization and Lecturer's Commitment on Academic Achievement among Public Tertiary Institutions in Gusau Educational Zone, Zamfara State, Nigeria

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Abstract

This study studied Correlation Between School Plant Organization and Lecturer's Commitment on academic Achievement among Public Tertiary Institutions in Gusau Educational Zone, Zamfara State, Nigeria. The study explored descriptive correlation approach, anchored in Systems Theory and Meyer and Allen's (1991) Three-Component Model of Organizational Commitment. The population of the study consist of one thousand and sixty tertiary institution lecturers during the 2024/2025 academic session in Zamfara State. A sample size of 286 lecturers were selected from the target population using proportionate and stratified random sampling technique. Data were obtained using a validated 31-item questionnaire (SPOLCQ) with a Cronbach's alpha of 0.997 and students' Cumulative Grade Point Average (CGPA) records, resulting in a 93.7% response rate. Findings found that school plant organization was somewhat competent ($M = 2.98$), while lecturers demonstrated a high level of devotion ($M = 3.18$). Pearson correlation analysis showed a modest positive association between school plant organization and academic achievement ($r = 0.412, p < 0.001$) and a stronger relationship with lecturers' commitment ($r = 0.521, p < 0.001$). Multiple regression analysis found that the two factors jointly explained 31.7% of the variance in students' academic achievement ($R^2 = 0.317, p < 0.001$), with lecturers' commitment emerging as the stronger predictor. The study suggests that both physical infrastructure and human commitment are crucial to academic performance, particularly in tough situations. It offers integrated approaches that simultaneously target facility improvement and lecturer welfare to increase educational quality in northern Nigeria.

Keywords: school plant organization, lecturers' commitment, academic achievement, tertiary institutions, Zamfara State

Introduction

Academic accomplishment in tertiary institutions remains a crucial predictor of human capital development, economic productivity and national development, particularly in developing countries. Globally, studies have repeatedly highlighted the quality of physical learning settings and the devotion of academic staff as two important determinants impacting students' learning results (Barrett et al., 2015; OECD, 2019; World Bank, 2023). School plant organization, which includes the adequacy, functionality, maintenance, accessibility, and strategic arrangement of physical facilities such as classrooms, laboratories, libraries, lecture halls, utilities and the campus environment, is critical to creating conducive conditions for effective teaching and learning. Similarly, lecturers' commitment, defined through Meyer and Allen's (1991) three-component model (affective, continuation and normative commitment), strongly affects instructional quality, student involvement, mentorship and overall academic achievement. In sub-Saharan Africa and particularly in Nigeria, these two variables take even greater significance due to chronic underfunding, fast population expansion and infrastructural shortfalls in state tertiary institutions. Several studies have proven beneficial connections between school plant quality and students' academic achievement (Adeyemi, 2010; Monity & Abam, 2024; Ogunbode & Oyewole, 2024). Likewise, lecturers' commitment has been found to be a powerful predictor of student success through improved instructional methods, encouragement and support (Ogunyemi & Ajayi, 2022; Sopia, 2020; Uwaleke, 2023). However, most current studies have explored these variables in isolation or within relatively stable environments, with limited attention paid to their combined predictive ability, especially in countries confronting complex security and socio-economic issues.



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The Gusau Educational Zone in Zamfara State, gives a particularly interesting background for this inquiry. Banditry, kidnappings and attacks on educational institutions have caused persistent insecurity in the zone, resulting in facility destruction, disruption of academic activities, teacher attrition and decreased student engagement. These issues exacerbate existing problems of inadequate infrastructure, poor maintenance culture and unsuitable working circumstances, producing a tough environment for both physical facilities and human resources to function properly. Despite these limitations, knowing how school plant organization and lecturers' commitment interact to influence students' academic progress (measured mostly by Cumulative Grade Point Average — CGPA) remains vital for evidence-based solutions. While earlier studies have highlighted the separate contributions of infrastructure and staff dedication, few studies have concurrently studied the joint influence of these variables in high-insecurity northern Nigerian tertiary institutions. This study tries to bridge this gap by evaluating the extent to which school plant organization and lecturers' commitment separately and jointly predict students' academic progress in public tertiary institutions in Gusau Educational Zone, Zamfara State.

The study is rooted on Systems Theory (Parsons, 1977), which views educational institutions as interconnected systems where inputs (school plants), processes (lecturers' commitment) and outputs (students' academic accomplishment) are dynamically related. It also draws from Meyer and Allen's (1991) organizational commitment theory.

Statement of the Problem

Despite many government interventions and policy reforms aimed at boosting post-secondary education in Nigeria, students' academic success in public university institutions in Zamfara State remains chronically low. This poor performance is particularly obvious in the Gusau Educational Zone, where students endure high failure rates, longer graduation times, and restricted academic growth. The situation is aggravated by inadequate school plant organization, characterized by badly kept classrooms, insufficient laboratories, restricted library resources, un-reliable utilities and overall un-conducive learning settings. At the same time, lecturers' commitment is increasingly tested by insecurity, poor welfare circumstances, enormous workloads and inadequate professional assistance. These issues create a tough teaching and learning culture that limits effective instruction and student involvement. Although earlier studies have analyzed school plant organization and lecturers' commitment independently but few have investigated their combined influence on students' academic progress, especially within high-insecurity zones like Gusau Educational Zone. This gap prevents a thorough understanding of how physical infrastructure and human resource elements interact to determine educational results in challenging environments. It is against this context that this study intends to analyze school plant organization and lecturers' commitment as determinants of students' academic progress in public tertiary institutions in Gusau Educational Zone, Zamfara State, Nigeria.

Objectives of the Study

1. Determine the prevalent level of school plant organization and lecturers' commitment in the selected public tertiary institutions.
2. Investigate the relationship between school plant organization and students' academic achievement.
3. Investigate the relationship between lecturers' commitment and students' academic achievement.
4. Determine the joint predictive influence of school plant organization and lecturers' commitment on students' academic performance.

Research Question

1. What is the prevalent level of school plant organization in public tertiary institutions in Gusau Educational Zone, Zamfara State, Nigeria?
2. What is the prevalent level of lecturers' commitment in public tertiary institutions in Gusau Educational Zone, Zamfara State, Nigeria?
3. What is the co-relationships between school plant organization and lecturers' commitment on students' academic achievement in public tertiary institutions in Gusau Educational Zone, Zamfara State?
4. What is the joint predictive influence of school plant organization and lecturers' commitment on students' academic achievement in public tertiary institutions in Gusau Educational Zone, Zamfara State?

Hypothesis

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



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H₀₁: There is no significant relationship between school plant organization and students' academic achievement in public tertiary institutions in Gusau Educational Zone, Zamfara State.

H₀₂: There is no significant relationship between lecturers' commitment and students' academic achievement in public tertiary institutions in Gusau Educational Zone, Zamfara State.

H₀₃: School plant organization and lecturers' commitment do not jointly have any significant predictive influence on students' academic achievement in public tertiary institutions in Gusau Educational Zone, Zamfara State.

Literature Review

Concept of School Plant Organization

School plant organization involves the systematic design, provision, sufficiency, functionality, maintenance and strategic spatial layout of physical facilities within an educational institution (Atolagbe, 2019). These amenities include classrooms, lecture halls, labs, libraries, workshops, administrative buildings, utilities (such as electricity and water supply), sanitation infrastructure and the general campus atmosphere (Mormah, 2023). A well-organized school plant is not just about the presence of structures but about producing a safe, comfortable, and functional learning environment that supports effective teaching and learning activities. Scholars note that the quality and management of school plants greatly influence the teaching-learning process by decreasing physical distractions, boosting student concentration, and encouraging practical and collaborative learning experiences. However, in resource-constrained contexts such as Nigeria, many public tertiary institutions continue to face challenges such as insufficient funding, a poor maintenance culture, overcrowding, and infrastructural decay, which frequently undermine the potential benefits of these facilities (Daniel et al., 2018; Adegbite and Lawal, 2016).

Concept of Lecturers' Commitment

Lecturers' commitment refers to the psychological bond, commitment, and readiness of academic staff to spend time, energy, and effort towards their institution, profession, and students' achievement (Uwaleke, 2023). It goes beyond mere contractual requirements and shows a deeper sense of responsibility and commitment in teaching and mentoring activities. In higher institutions, this commitment is regarded a critical human resource aspect that directly determines the quality of instruction and overall institutional effectiveness. The concept is best explained through Meyer and Allen's (1991) three-component model of organizational commitment, which includes affective commitment (emotional attachment and identification with the institution), continuance commitment (perceived costs of leaving), and normative commitment (sense of moral obligation and loyalty). In the Nigerian context, lecturers' commitment is molded by both intrinsic elements such as job satisfaction and professional calling, and external factors including compensation, working conditions, infrastructure, and security concerns (Ogunyemi & Ajayi, 2022). Despite these limits, many academics in northern Nigeria continue to display remarkable commitment, frequently inspired by personal ideals and a feeling of duty. Committed lecturers greatly boost students' academic progress by maintaining high standards of teaching, giving mentorship, offering timely feedback and fostering supportive learning environments (Okoro, 2023). Their passion creates stronger student motivation, engagement, and persistence, making professor commitment one of the biggest indicators of academic success in higher education institutions.

Relationship between School Plant Organization, Lecturers' Commitment and Students' Academic Achievement

School plant organization and lecturers' devotion are widely regarded as key aspects that influence students' academic progress in higher institutions. A well-organized school plant provides the physical foundation for effective teaching and learning by assuring adequate classrooms, functional laboratories, well-stocked libraries, reliable utilities and a congenial campus climate (Barrett et al., 2015). When these facilities are appropriately planned, maintained and accessible, they assist alleviate physical discomfort, eliminate distractions, and provide conditions that foster sustained student attention and participation. Lecturers' devotion, on the other hand, symbolizes the human factor that lends life to the physical infrastructure. Committed lecturers are more likely to utilize available facilities creatively, prepare thoroughly for courses, employ new teaching tactics, and provide constant academic and emotional support to students (Ogunyemi & Ajayi, 2022). Their passion generally translates into superior instructional quality, increased student motivation and improved learning results, even while working under constricted conditions.

The interaction between these two variables is not only additive but often synergistic. Good school plant organization promotes the efficacy of devoted lecturers by giving them with the essential tools and atmosphere to perform efficiently.



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Conversely, highly motivated lecturers can maximize the utility of even modestly sufficient facilities by innovative techniques and good facility management. This connection provides a more potent combined influence on students' academic achievement than either component in isolation (Adegbite & Lawal, 2016). Empirical studies have continuously established good links between school plant organization and academic performance, as well as between lecturers' devotion and student success. However, research evaluating the joint predictive ability of both factors remains sparse, particularly in northern Nigeria. In the context of Gusau Educational Zone, where insecurity and infrastructural constraints are prominent, understanding this linked relationship becomes even more crucial for policy and practice. The present study consequently contributes to the literature by analyzing how school plant organization and lecturers' commitment separately and collectively influence students' academic progress in public tertiary institutions within this demanding environment. Such an integrated approach offers deeper insight into the complex factors that impact educational results in resource-constrained and insecurity-affected communities.

Empirical Evidence and Research Gap

Empirical studies have continuously emphasised the favourable influence of school plant organization on students' academic progress. For instance, Adeyemi (2010) and Monity and Abam (2024) discovered that appropriate and well-maintained physical amenities such as classrooms, laboratories, and libraries greatly boost student engagement, attendance, and overall performance. In many Nigerian institutions, schools with better-organized school plants tend to achieve higher academic outcomes compared to those with outdated infrastructure. Similarly, a rising body of evidence reveals the substantial link between lecturers' devotion and students' academic accomplishment. Ogunyemi and Ajayi (2022) observed that lecturers who exhibit high levels of affective and normative commitment are more effective in engaging students and increasing learning outcomes. Their study, along with others, reveals that committed lecturers often yield superior student performance through persistent support and quality training. When both variables are analyzed together, their joint influence looks considerably more important. Adegbite and Lawal (2016) and Atolagbe (2019) showed that the combination of good school plant organization and high lecturer commitment generates better predictive power on academic achievement than when studied independently. This synergy shows that infrastructure and human variables reinforce one other in establishing optimal learning circumstances. However, most existing studies have explored these variables either in isolation or within southern and urban sections of Nigeria. For example, Adeyemi (2010) concentrated on school facilities in Osun, Ondo, and Ekiti States, Daniel et al. (2018) did their study in Akwa Ibom State, while Atolagbe (2019) investigated school plant organization in Osun State. Relatively few studies have studied their combined consequences in northern Nigeria. In the specific context of Zamfara State, empirical evidence on this topic remains scant. While insecurity has been widely reported as a key disruptor of education in the region (Dahiru & Almustapha, 2025; Esther & Ahon, 2024), little is known about how school plant organization and lecturers' commitment operate as predictors of student progress amid these obstacles. Most available studies have focused on secondary education or more stable situations. The present study therefore addresses this important research gap by providing empirical evidence on the individual and joint predictive influence of school plant organization and lecturers' commitment on students' academic achievement in public tertiary institutions in Gusau Educational Zone, Zamfara State. By focusing on this under-researched area, the study intends to offer significant insights for policy and practice in tough educational environments.

Theoretical Framework

This study is built on two fundamental theories. The first is Systems Theory (Parsons, 1977), which views educational institutions as open systems encompassing inputs, processes, and outputs. In this study, school plant organization represents the structural input, lecturers' commitment acts as the human process, and students' academic accomplishment is the result. The idea highlights the interdependence of these variables for good institutional functioning. The second is Meyer and Allen's (1991) Three-Component Model of Organizational Commitment. This paradigm describes lecturers' commitment through three dimensions: affective (emotional connection), continuation (perceived costs of leaving), and normative (feeling of obligation). These dimensions assist understand why lecturers remain dedicated despite demanding working conditions. Together, these theories provide a robust platform for studying how school plant organization and lecturers' commitment separately and jointly predict students' academic progress in the setting of Gusau Educational Zone.



Research Methodology

This study utilized a descriptive correlation research design. The design was chosen appropriate because the study wanted to analyze the levels of the independent variables and examine their correlations with the dependent variable. The target population comprises 1,060 lecturers from six public tertiary schools in Gusau Educational Zone, Zamfara State. A sample of 286 lecturers was generated using Taro Yamane's method and proportionate stratified random sampling technique to achieve fair representation among the institutions. Data were collected using a validated 31-item questionnaire titled School Plant Organization and Lecturer Commitment Questionnaire (SPOLCQ). The test was divided into sections addressing demographic information, school plant organization (16 items), and lecturers' commitment (15 items), scored on a 4-point Likert scale. The questionnaire showed an excellent internal consistency with Cronbach's alpha of 0.997. Students' academic achievement was judged using their Cumulative Grade Point Average (CGPA) derived from institutional records. Data collection was carried out after getting formal clearance from the selected institutions. Completed questionnaires were retrieved immediately from respondents, providing a response rate of 93.7 percent (268 useable replies). Data were analyzed using the Statistical Package for the Social Sciences (SPSS Version 22). Descriptive statistics (means and percentages) were utilised to answer study questions one and two, while Pearson Product Moment Correlation and Multiple Linear Regression were employed to evaluate the hypotheses at 0.05 level of significance.

Presentation of Results

Table 1: Response Rate of Respondents

Category	Frequency	Percentage
Questionnaires Administered	286	100%
Questionnaires Returned	268	93.7%

Out of 286 questionnaires provided to teachers throughout the six public tertiary institutions in Gusau Educational Zone, 268 were duly completed and returned. This represents a high response rate of 93.7%. The excellent response rate shows strong cooperation from the respondents and promotes trust in the representativeness and reliability of the findings.

Table 2: Demographic Characteristics of Respondents (Years of Experience)

Years of Experience	Frequency	Percentage
0 – 2 Years	51	19.0%
3 – 5 Years	74	27.6%
6 – 9 Years	83	31.0%
10 Years and Above	60	22.4%
Total	268	100%

The demographic analysis revealed a well-balanced distribution of responders by years of teaching experience. Nineteen percent (19.0%) had 0–2 years of experience, 27.6% had 3–5 years, 31.0% had 6–9 years, and 22.4% had 10 years and more. This dispersion across multiple career stages improved the data by obtaining opinions from both rookie and highly experienced teachers.

Research Question One (RQ1):

What is the prevalent level of school plant organization in public tertiary institutions in Gusau Educational Zone, Zamfara State, Nigeria?

Table3: Level of School Plant Organization

Variable	Mean	SD	Interpretation
Overall School Plant Organization	2.98	0.64	Moderately Adequate

The study revealed that the level of school plant organization in the selected public tertiary institutions was generally perceived as moderately adequate, with an overall mean score of 2.98 on the 4-point Likert scale. Respondents gave high ratings to core instructional facilities such as ventilation and lighting ($M = 3.52$), electricity and water supply ($M = 3.43$), and availability of instructional materials ($M = 3.38$). However, lower ratings were recorded for restrooms ($M = 2.43$), general cleanliness ($M = 2.44$), security measures ($M = 2.48$), and health facilities ($M = 2.48$). These findings indicate that while basic teaching spaces are reasonably functional, auxiliary facilities still require significant improvement.



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Research Question Two (RQ2):

What is the prevalent level of lecturers' commitment in public tertiary institutions in Gusau Educational Zone, Zamfara State, Nigeria?

Table 4 Level of Lecturers' commitment

Variable	Mean	SD	Interpretation
Overall Lecturers' Commitment	3.18	0.54	High

Lecturers in the Gusau Educational Zone demonstrated a high level of commitment, with an overall mean score of 3.18. The respondents showed particularly strong affective commitment (emotional attachment) and normative commitment (sense of obligation). High mean scores were recorded on items such as willingness to spend the rest of their career in the institution ($M = 3.66$), perceived loyalty ($M = 3.59$), and belief that they have few alternative job options ($M = 3.74$). This high commitment level is noteworthy given the challenging security and infrastructural context of the zone.

Research Question Three (RQ3):

What is the Co-relationships between school plant organization and Lecturer's Commitment on students' academic achievement in public tertiary institutions in Gusau Educational Zone, Zamfara State?

Table 5: Pearson Product Moment Correlation Analysis

Variables	r-value	p-value	Remark
School Plant Organization ↔ Academic Achievement	0.412	< 0.001	Moderate positive, significant
Lecturers' Commitment ↔ Academic Achievement	0.521	< 0.001	Strong positive, significant

As presented in Table 5, school plant organization had a moderate positive and statistically significant relationship with students' academic achievement ($r = 0.412$, $p < 0.001$). Lecturers' commitment showed a stronger positive and highly significant relationship with academic achievement ($r = 0.521$, $p < 0.001$). This suggests that lecturer commitment has a greater individual influence on student performance than school plant organization in this context.

Research Question Three (RQ4):

What is the joint predictive influence of school plant organization and lecturers' commitment on students' academic achievement in public tertiary institutions in Gusau Educational Zone, Zamfara State?

Table 6: Multiple Linear Regression Analysis

Model	R	R ²	Adjusted R ²	F	p-value
School Plant Organization + Lecturers' Commitment	0.563	0.317	0.311	—	< 0.001

The multiple regression analysis (Table 2) demonstrated that school plant organization and lecturers' commitment jointly accounted for 31.7% of the variance in students' academic achievement ($R = 0.563$, $R^2 = 0.317$, Adjusted $R^2 = 0.311$, $p < 0.001$). This finding reveals a large joint predictive influence, with lecturers' commitment appearing as the stronger predictor. The model was statistically significant, confirming that both variables make considerable contributions to students' academic achievements.

Discussion of Findings

The findings of this study offer vital insights into the predictive functions of school plant organization and lecturers' commitment on students' academic progress at public tertiary institutions located in a tough security environment. The high response rate (93.7%) and different experience levels of respondents lend confidence to the results. The survey indicated that school plant organization was viewed as moderately adequate (overall mean = 2.98). This conclusion is consistent with earlier research conducted in different locations of Nigeria. For example, Adeyemi (2010) and Monity and Abam (2024) identified similar patterns where essential academic facilities were sufficiently available although supporting amenities such as sanitation and security remained inadequate. The moderately positive correlation ($r = 0.412$, $p < 0.001$) between academic achievement and school plant organization is consistent with research by Barrett et al. (2015) and Adegbite and Lawal (2016), which found that better physical infrastructure significantly, but not significantly, improves student performance. A significant finding was the high degree of lecturers' commitment (overall



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mean = 3.18) despite prevailing challenges. This result confirms Ogunyemi and Ajayi (2022), who reported significant commitment among lecturers in Nigerian universities even under tough situations. In line with Sopiah (2020) and Uwaleke (2023), who found that lecturer commitment is frequently a more potent driver of student success than infrastructural factors alone, particularly in resource-constrained settings, the current study found a stronger relationship between lecturers' commitment and academic achievement ($r = 0.521, p 0.001$). When analyzed combined, school plant organization and lecturers' commitment accounted for 31.7% of the variance in students' academic achievement. This research corroborates Atolagbe (2019) and Adegbite and Lawal (2016), who showed that the combination of physical infrastructure and devoted teaching staff creates a stronger effect than either variable separately. The study also gives empirical support to Systems Theory, revealing how structural inputs and human processes interact to produce educational results. Generally speaking, the present study extends existing literature by providing evidence from an under-researched, insecurity-affected region in northern Nigeria. While the findings on individual relationships are essentially consistent with past studies conducted mostly in southern Nigeria, the substantially higher influence of lecturers' commitment emphasizes the durability of human variables in tough situations. This shows that in situations like Gusau Educational Zone, investment in both infrastructure and lecturer motivation is crucial for real improvement in academic output.

Conclusion

This study studied school plant organization and lecturers' commitment as determinants of students' academic progress in public tertiary institutions in Gusau Educational Zone, Zamfara State, Nigeria. The findings found that school plant organization was somewhat sufficient, while instructors demonstrated a high level of devotion despite the demanding operational environment. Both variables revealed significant positive connections with students' academic achievement, with lecturers' commitment appearing as the stronger individual predictor. Jointly, the two variables explained 31.7% of the variance in students' academic achievement. These results confirm that quality physical infrastructure and dedicated teachers are essential drivers of academic achievement. However, they also underline that human commitment plays a particularly essential role in resource-constrained and insecurity-affected environments. The study underscores the significance of Systems Theory, which highlights the interconnection of structural inputs and human processes in generating educational results. In conclusion, a balanced and integrated strategy is needed to raise students' academic performance in Gusau Educational Zone public postsecondary institutions. Sustained investment in school plant development must be supported by purposeful measures to boost lecturers' commitment through improved welfare, professional development, and a secure working environment. Such integrative approaches are vital for boosting educational quality in tough places like northern Nigeria.

Recommendation

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

1. School officials and the government should place greater emphasis on improving school plant organization. This includes regular maintenance of classrooms, laboratories, libraries, and utilities, as well as providing better security and sanitation facilities. Since the study found school plant organization to be only moderately adequate (overall mean = 2.98), creating a more favourable physical environment will enhance effective teaching and learning.
2. There is a need to improve lecturers' commitment through practical measures. The government and institutions should ensure regular payment of salaries, promote opportunities for professional development, and establish improved working conditions. Recognizing and rewarding dedicated lecturers can also help sustain their drive. This recommendation is based on the finding that lecturers demonstrated a high level of commitment (overall mean = 3.18), yet operate under challenging conditions.
3. Educational authorities should adopt an integrated approach that addresses both school plant organization and lecturers' commitment simultaneously. Improving infrastructure alone is not sufficient; it must be accompanied by motivated and committed teaching staff. Both elements should be viewed as equally essential in institutional planning and policy-making. This is informed by the finding that the two variables jointly explained 31.7% of the variance in students' academic achievement, with lecturers' commitment emerging as the stronger predictor.
4. Comparable studies should be conducted in other parts of northern Nigeria to provide greater insight and more generalizable conclusions. This will help policymakers develop more effective interventions for enhancing academic attainment in challenging environments.



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Effect of Field-Trip Strategy on achievement in ... Arabi, Y. A. (2026)

Effect of Field-Trip Strategy on Achievement in Geography Concepts among Rural and Urban Secondary School Students in Adamawa State, Nigeria

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Abstract

This study investigated the effect of Field-Trip Strategy on academic performance of geography students among secondary schools of Adamawa State, Nigeria. Two research questions and two hypotheses. The study adopted a quasi-experimental research design with pretest and posttest. The population consisted of 12,366 SS II students, with a sample size of 240 senior secondary school (SSII) students offering geography from four secondary schools. The experimental group was taught using field trip teaching strategy while the control group was taught using lecture method. The instrument for data collection was Geography Achievement Test (GAT), comprising 50 items with a reliability value of 0.71. Research question was answered using descriptive statistics of mean and standard deviation, while hypothesis was tested at 0.05 level of significance using ANCOVA. The study shows that school location has significant effect on students' academic performance $F=481.03(df_{1,239})$, $P \leq 0.05$. Also, there is no significant effect of gender on students' performance in Adamawa state. The study recommends that schools in rural areas should be equipped with furniture, teachers and facilities to facilitate students' academic performance. Geography teaching and learning should encouraged students' participation in field trips in secondary schools.

Keywords: Field trip, Rural and Urban locations, Academic performance, Gender

Introduction

The rural-urban location has been found all over the world to be an important indicator of differences in performance among students. School location in rural environments attain lower scores when compared to their urban counterparts (Dennis, 2012). The location of a school plays a significant role in the academic achievement of students. Akinyele (2012) stated that the immediate environment of a child plays a major role in his socialization and the area in which a school is located may affect their academic achievement. Akpan (2016) further stated that school location is one of the major factors that affect students' academic achievements. According to Orji (2016) indicated that school location refers to rural and urban schools. A school located in a rural area is usually faced with problems such as shortage of teachers, lack of laboratories, poorly equipped laboratories, among others. These shortcomings negatively affect both students' interest, motivation and achievement. Evidence revealed that the educational aspirations of students who study in rural areas are weaker than those of their urban counterparts (Hum, 2013; Arnold, 2015). Dennis (2019) found that schools in the rural environment achieve lower scores when compared to their urban counterparts. Similarly, Macmillan (2012) found that students in rural areas put less value in their studies, and as such, their achievements are affected. Urban schools are those in municipalities or towns, while rural schools are located in villages or semi-urban areas. Frederick (2015) views school location as one of the major factors that influence students' academic achievement in some subject areas. Many parents consider factors such as the location of schools (urban or rural) and the distance to the school before enrolling their wards. Owoye and Yara (2016) noted that many parents prefer their children to attend schools in urban areas because they believe that students from urban schools perform better than their counterparts from rural schools.

Statement of the Problem

Geography is taught with the objective that learners will acquire basic foundation skills on their physical environment to propel them towards making valuable contributions to society. However, it was observed by Amasun (2008), Sanlera (2016), and WAEC chief examiners' reports (2018) that the poor performance of students in both internal and external examinations in recent times is high. This ugly trend might have resulted from a lack of qualified teachers, curriculum issues, school location, and method of teaching used by geography teachers. Rural-urban location has been found worldwide to be an important indicator of differences in education performance. It has become necessary to conduct a study on the effect of school location on students' academic performance in geography.



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Purpose of the Study

The study was guided by the following objective:

1. To determine the effect of Field-Trip Strategy on academic performance in Geography Concepts among secondary school student in Adamawa state.
2. To determine the effect of Field-Trip Strategy on academic performance in Geography Concepts among secondary school male and female students in Yola.

Research Question

1. What is the pretest and posttest mean score of students taught geography concepts using field trip strategy and those taught using conventional lecture methods on school location in Adamawa state?
2. What is the pretest and posttest mean score of students taught using teaching methods based on gender in Adamawa state?

Hypothesis

H₀₁: There is no significant effect of school location on students taught geography concept using field trip in Adamawa state.

H₀₂: There is no significant effect of field-trip teaching methods on student academic performance in geography Concept based on gender.

Concept of School Location

The concept of school location refers to schools that are located in rural or urban areas. Urban schools are those in the municipalities or schools found within the towns, and rural schools are those located in the villages or semi-urban areas. Frederick (2015) views that many parents consider factors such as the location of schools (urban or rural) and the distance to the school before enrolling their wards. Orji (2017) explained that many students in the interior villages struggle with the challenge of walking long distances to school. The implication is that when people in urban areas convey their children to school by vehicle and enjoy minimum traveling distances to acquire education, others in rural places suffer by having to cover maximum distances to acquire education. This implies that school location may contributed significantly to students' poor achievement.

Research Methodology

This study adopted a quasi-experimental pre-test, post-test non-equivalent control group design. This is because there was non-randomization of students to the groups. Similarly, secondary school classes exist as intact group, and school authorities do not allow any attempt to dismantle and reconstitute them for the purpose of research. The design can be presented symbolically as:

EG $O_1 \rightarrow X_1 \rightarrow O_2$
 CG $O_1 \rightarrow X_0 \rightarrow O_2$

The study use two groups experimental and control. The experimental group (EG) was taught using fieldtrip teaching strategy (X₁) while the control group (CG) was taught using lecture method (X₀). The two groups (experimental and control) were given a pre-test (O₁) to determine the entry level of students. The two groups were taught geography concept for a period of six weeks. Then post-test (O₂) were administered to the groups in order to determine the impact of teaching methods on students performance in senior secondary schools in Adamawa State, Nigeria. The study was conducted in Adamawa State, Nigeria. A total of 12,366 SSII students in senior secondary schools offering geography in Adamawa State. The sample for the study consisted of 240 SSII geography students from four senior secondary schools in Gombi Local Government Area. The schools were Government Day Secondary School Gombi, Government Day Secondary School Gaanda, Government Secondary School Gombi, and Government Day Secondary School Muchala. One intact class was chosen randomly from each school. Purposive sampling technique was used to select co-educational, mixed schools in rural and urban areas. The instrument for data collection was a performance test tagged "Geography Achievement Test (GAT)". The GAT is a 50-item multiple-choice objective test with four options. The instrument was adapted from past West African Examination Council (WAEC) examination questions from 2015 to 2022 and was validated. Split-half reliability method was used for reliability. The data collected were correlated using Pearson Moment Correlation Coefficient to obtain half reliability coefficient, and Spearman Brown Prophecy formula was used and the index of 0.71 was obtained.



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The study was conducted in six weeks. The pre-test was administered in the first week to both the experimental and control groups. The experimental group was exposed to treatment through field trip teaching strategy while the control group was taught through the conventional lecture method. The topics taught were Weathering, Soil Erosion, and Settlement. Posttest was administered to both groups after six weeks of instruction. The research questions were answered using descriptive statistics of mean and standard deviation, while the hypotheses were tested at 0.05 level of significance using ANCOVA.

Presentation of Results

Research Question 1: What is the pretest and posttest mean score of students taught geography concepts using field trip based on school location in Adamawa state?

Table 1: Mean and Standard Deviation of pretest and posttest mean score of students taught geography using field trip method based on school location in Adamawa state

School Location	n	Pretest Mean	SD	Posttest Mean	SD	Mean Diff
Rural	129	10.64	2.97	45.82	2.50	35.18
Urban	111	11.32	2.82	45.54	2.38	34.22

The descriptive statistics in Table 1 revealed that rural schools with 129 students had a pretest mean score of 10.64 and standard deviation of 2.97. In the posttest, the rural students had a slightly higher mean score of 45.82 with a standard deviation of 2.50. Urban schools with 111 students had a mean score of 11.32 and standard deviation of 2.82 at pretest level and mean score of 45.54 with standard deviation of 2.38 at posttest level. In summary, the mean difference between rural and urban students is slightly equal, which means rural and urban students performed almost equally, subject to confirmation by testing the corresponding hypothesis.

Research Question 2. What is the pretest and posttest mean score of students taught using Field-Trip teaching methods based on gender in Adamawa state?

Table 2. Mean and Standard Deviation of pretest and posttest mean score of students taught using Field-Trip teaching methods based on gender in Adamawa state.

Gender	N	Pretest		Posttest		Mean difference
		Mean	S.D	Mean	SD	
Male	128	3.15	10.76	45.51	2.47	0.38
Female	112	11.12	2.63	45.89	2.41	

Table 2 indicated that, 128 male students had a pretest mean score of 10.76 with standard deviation of 3.15. In the posttest, the male students have highest mean score of 45.51 with a standard deviation of 2.47. while 112 female students had a mean score of 11.13 and standard deviation of 2.63 at pretest. While mean score of 45.89 with standard deviation of 2.63 at posttest. The mean difference between of male and female students is 0.38 in favor of female students.

Testing of Hypotheses

H₀₁: There is no significant effect of school location on students taught geography concept using field trip in Adamawa state.

Table 3: ANCOVA on main effect of school location on students' performance in Adamawa state

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Eta
Corrected Model	12.124 ^a	2	6.062	1.012	.000	.718	
Intercept	31668.589	1	31668.589	5289.038	.000	.957	
PRETEST	7.408	1	7.408	1.237	.188	.005	
SCHOOL_LOCATION	6.183	1	6.183	481.033	.000	.724	
Error	1419.059	237	5.988				
Total	502486.000	240					
Corrected Total	1431.183	239					

a. R Squared = .008 (Adjusted R Squared = .000)

The results of the analysis in Table 3 show that there is a significant effect of school location on students' performance in Adamawa state $F = 481.03$ (df 1, 239), $P = 0.000$. Since the computed p-value (0.000) is less than 0.05 level of significance, the null hypothesis is rejected, and it is concluded that there is a significant effect of school location on students' performance in Adamawa state. The partial eta square of 0.724 indicates that 72% of students' performance in this study was as a result of differences in school location.



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H0₂: There is no significant effect of field-trip teaching methods on student academic performance in geography Concept based on gender.

Table 4. ANCOVA on main effect of gender on students' performance in Adamawa state.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	13.583 ^a	2	6.792	1.135	.323	.009
Intercept	32268.621	1	32268.621	5394.796	.000	.958
PRETEST	5.083	1	5.083	.850	.358	.004
GENDER	7.642	1	7.642	1.278	.259	.005
Error	1417.600	237	5.981			
Total	502486.000	240				
Corrected Total	1431.183	239				

a. R Squared = .009 (Adjusted R Squared = .001)

Table 4 shows that, there is no significant effect of gender on students' performance in Adamawa state $F = 1.28$ (df 1, 239), $P = 0.259$. Since the computed p-value (0.259) is greater than 0.05 level of significant, therefore, the null hypothesis of no significant difference is upheld, and concluded that there is no significant effect of gender on students' performance in Adamawa state. The partial eta square of 0.005 indicates that, 0.5% of students' performance in this study was as result of difference in gender.

Discussion of Findings

The study revealed that there is a significant effect of school location on students' academic performance in Adamawa state. This finding is supported by Considine and Zappaa (2016) who found that geographical location does not significantly predict the outcomes in students' performance in schools. Similarly, Philiat (2016) has proven that students in urban areas had better academic achievement than their rural counterparts and also performed equally as well. In the same vein, Frederick (2016) observed a significant difference in urban-rural performance and that location exerted some significant measure of influence on students' achievement in Agricultural Science Achievement Test (ASAT). Giving credence to the above, Owioye and Yara (2016) found a significant difference in the academic achievement of students in urban and rural areas in senior school certificate examinations in Ekiti State. This implies that students in urban areas had better academic achievement than their rural counterparts. On the contrary, Precisely, Onuoha (2017) found that there is no significant difference between students' academic achievement in rural and urban areas. Considine and Zappaa (2016) found out that geographical location does not significantly predict outcomes in school performance. This implies that students location influences their academic achievement. The study also found that there is no significant effect of gender on students' performance in Adamawa state. This study agreed with Chinedu (2018) who revealed that gender and location do not have influence on students' level of awareness and attitude. The study implies that gender had no significant effect on students' offering geography when taught using field trip.

Conclusion

School location has significant effect on students' academic performance when taught geography concepts using field trip teaching method. Also, gender has no effect on student academic performance in geography when taught using field trip teaching method.

Recommendations

The following recommendations are made:

1. Geography teaching and learning activities should encourage students' participation in field trips in secondary schools as it is often neglected.
2. The gaps in terms of school location should be filled by supplying enough teachers and facilities.
3. Schools in rural areas should be equipped with furniture, teachers and facilities to facilitate students' academic performance.



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Leveraging Artificial Intelligence Technology on Teacher Education programs among higher institutions of learning: A Bane or Blessing for sustainable quality Education in Nigeria?

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Abstract

In spite of the substantial body of studies carried out on the effects of Artificial Intelligence on teacher education programs in Nigeria, nuances of opinion abound on whether AI is a blessing or bane in the teaching learning process. Some scholars believed that the infusion of AI into the teacher education programs is a blessing because it helps to make work easier for students, it can function as a reliable research partner, and it can offer personalized learning resources, video, articles, and interactive activities among others. Conversely, the critics of AI justified their position by claiming that AI undermines critical thinking skills for students and teachers alike. In addition, AI correlates with increased students' laziness because of a loss of human decision making and lastly, robust classrooms interaction will be greatly minimized if not totally obliterated. This paper, therefore, critically examines the concept of teacher education, Artificial Intelligence, its usefulness and limitations and offers suggestions on how balance could be struck between Artificial Intelligence (AI) and Human Intelligence in teacher education programs in Nigeria.

Keywords: Artificial Intelligence, Teacher Education, Personalised learning resources, Human intelligence

Introduction

The traditional African society prior to the advent of colonialism had forms of teaching and learning systems in which the parents or elders inculcated societal norms and values on the younger generation or to one another. This kind of education is purely informal as there was no organised body of knowledge and curriculum. Every adult in the community was regarded as a teacher. The system was didactic, simple and pragmatic. It was didactic because it emphasized moral aspect of life; virtues like honesty, truth, hardworking, respect for elders were taught. It was simple because there was no formal training for the teacher; the process depended on everyday experiences using tangible and intangible materials found in the environment such as artifacts, crafts, natural resources, festivals, folklores, arts, proverbs, idioms etc. to aid teaching and learning which are still in use today to preserve our cultural heritage. The pragmatic aspect of African education lies in fact that the recipient of the education did not look for job after graduation. For example, the child of a carpenter automatically learns his father's skill and practices it after mastering the skill of carpentry. The same goes for the child of a farmer and other professions. Today, education and teaching have taken a new dimension as there are trained persons entrusted with the right and responsibilities to carry out teaching function, otherwise called teachers. What is referred to as teaching today takes place whenever there is a deliberate structured process of facilitating learning, imparting knowledge, skills and values to others. It is both an art and a science that involves designing educational environments, guiding learners, and fostering critical thinking. Consequently, individuals referred to as teachers must pass through some specific and specialized training through designated platforms and specialised programs and process called 'Teacher Education'. In agreement with the above, and given the specialised teachers' role in the developmental process of all individuals and the nation, the Federal Government of Nigeria presently places high premium on the teaching profession as revered in the National Policy on Education which states among other goals of teacher education is to produce highly motivated, conscientious and efficient classroom teachers for all levels of education system, provide teacher with intellectual background and professional background adequate for their assignment and to make them adaptable to changing situations (Federal Republic of Nigeria, 2013). Lending credence to the National Policy on Education, Obanya (2011) sees the existing profile of teacher as professional with a minimum of Nigerian Certificate in Education having gone through general education for 3 years as in the Nigerian case. Such a person is usually described as a qualified teacher. However, Obanya (2011) notes that a qualified teacher is not necessarily a competent teacher; also, a competent teacher is not necessarily an efficient teacher while an efficient teacher is not necessarily an effective teacher. He further explains that a qualified teacher is one with the



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requisite/prescribed minimum general and professional qualifications. Here, the emphasis is on undergoing prescribed courses and being crowned with an approved certificate that confers an approved qualification. A competent teacher is one who, in addition to being qualified, is also knowledgeable in methods and principles of promoting learning in students. Higher on the scale is the efficient teacher, who is able to apply the prescribed teaching methods 'as directed'. Higher still is the effective teacher, who has mastered the prescribed methods, but applies them creatively, and as a result ensures quality learning students. While this paper agrees with assertion of Obanya (2011) that the 21st century should be efficient, it adds that today's teachers should align with the competitive contemporary global community, via global best practices, brought by the emerging technologies such as artificial intelligence. Mormah & Bassey (2011) aver that the essence of teacher education is to inculcate in a would-be teacher, acceptable attitudinal, behavioural, knowledge, values and skills approvable by educational and socio-political policy makers and implementers. According to Ukoha (1999), the way to train teachers with these cherished qualities is through professional teacher training that will result in an educated person who possesses a firm grounding of chosen subject matter. Apart from all the attributes mentioned above, an effective teacher should aware of the role of modern technologies in teacher education program. Technology has the potentials for making teaching easier and its spread has been quite breath-taking even in the third world countries. It is therefore expected of a 21st century teacher to be acquainted with the latest technology so as to make his classroom more engaging, compelling and interactive.

Emerging Technologies and Teacher Education

Today's digital age, where we have various technologies for teaching and learning, has brought a new face of teachers to the classroom. It is an interconnected, communication and technologies intensive age, borderless in its reach, using computer and the internet to create a world of e-everything: e-learning, e-commerce, e – banking, e – governance, e – roting, e – publishing, e – book, e – library, e – dating etc. The 21st century classroom, therefore, requires a new face of teachers with an ICT complaint status and mindset to support the teaching processes: new technologies bring fundamental changes to the lines of 21st century learners, who are the most frequent users of emerging technologies and online service (OECD, 2016). To key into global best practices in education, FRN (2013) stated that, teaching and learning should be activity-based, learner – centred and experimental as well as Information Technology (ICT) supported. The emerging technologies include the internet backbone as well as other electronic media devices and facilities that ensure. E – learning such as: broad broadband desktop, laptop, tablets, smartphones, and other hand-held devices, wide range of electronic technology devices such as radio, cassette tapes, audio streams, downloadable packages, internet services, television, Ipad, interactive boards etc. The latest of the emerging technologies in teacher education is Artificial Intelligence which is the concern of this paper.

Concept of Artificial Intelligence

Artificial Intelligence refers to a machine or computer system's ability to perform tasks that would typically require human intelligence. It involves programming system to analyse data, learn from experiences, and make smart decision – guided by human input. According to Oluwole (2025), AI is revolutionizing education, reshaping how knowledge is delivered, accessed and evaluated. In other words, the scholar seems to say that integration of AI into learning environments has initiated a paradigm shift that transcends traditional classroom boundaries. In recent time, Artificial intelligence has been in the spotlight. Countless academic conferences in Nigeria and beyond have their themes on what AI can do and what it cannot do. The theme seems over- flogged and educators and scholars are divided over whether the attention given to the AI literally worth it. Some vehemently oppose its usage leveraging on the fact that not all information given by AI are absolutely correct and it could also make students and teachers as well intellectually lazy. However, scholars like Luan, Geczy, Lai, Gobert, Yang, Ogata (2020) are of the opinion that, ignoring this new technology because of the perceived dangers is like throwing away the baby with the bathwater. It is also a considered opinion of some scholars like Musa (2021), Rodinadze & Zarbazola (2012), that educators need to strike a balance between AI technology as an aid for teaching and learning while still encouraging face to face interactions between teachers and learners.

Benefits of AI in Teaching Education Programs

Surprising shifts emerge as machines begin helping those who teach others. Some now see classrooms guided by smart systems instead of just humans alone. A shift unfolds quietly - tools learn patterns, suggest responses, adapt to individual styles. Not magic, but math shaping feedback in real time. Questions arise about fairness, control, oversight. Still, many believe careful use brings stronger outcomes than old methods alone. Benefits of AI, according to scholars like Michalski,



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Carbonelli & Mitchell, (2013) Roll & Wylie (2016), Musa (2025) include but not limited to the following:

Personalization Meets Adaptive Learning

What makes AI stand out in training educators lies in how it shapes learning to fit each person. Instead of treating everyone the same way, smart systems study how fast someone learns, where they struggle, and what they already know - then shift materials on the fly. These changes feel natural; much like the tailored teaching methods future instructors must later use themselves. By doing so, the tech doesn't just build skills - it shows them in action. Training becomes less about rules, more about real-time example.

Smart Feedback and Grading

Out here, AI reshapes how assessments unfold in teacher training programs. Using pattern recognition and text analysis tools, these systems review lesson designs, personal reflections, and professional collections faster and more precisely than human grading typically allows. What stands out most? Instant feedback loops - offering useful insights right when they matter. Future teachers get suggestions quickly, sometimes minutes after submitting tasks, helping them adjust and grow without long delays. With less time spent on repetitive scoring, instructors shift toward meaningful conversations, coaching moments, and building trust - areas machines simply can't touch.

Simulations and microteaching spaces

One way AI stands out in training teachers is through lifelike simulations where risks are minimal. Instead of real students, future educators face digital ones, each programmed with unique reactions and challenges. From behind a screen, they try different teaching styles, test how well they handle disruptions, or see if their questions spark thinking. Mistakes happen here without consequence, part of the process rather than something to fear. Feedback follows - sharp, specific, focused on timing, tone, clarity, how learners respond. Real classrooms wait beyond these trials, intense and unforgiving by comparison. Old methods like short mock lessons feel limited next to what these systems provide, packed with insights and room to adapt.

Knowledge and Professional Resources Access

Sometimes a quiet tool opens doors that once seemed stuck. Instant answers appear when student teachers ask, not through endless scrolling but by tapping into smart systems full of teaching methods backed by evidence. Curriculum maps, real classroom examples, plans ready to adapt - these come together without digging through dusty archives. Help shows up right when it's needed, shaped around the situation at hand. Faraway colleges or schools with little often miss out on fresh ideas and expert insight. Now gaps shrink because support travels fast, skipping roads and borders. Old limits fade when information moves like conversation.

Inclusive and Equitable Teacher Preparation

Learning tools powered by technology might help balance chances for everyone in teacher training. Real-time typing, translation features, or spoken text options open doors - especially when someone faces hearing challenges, speaks another language at home, or learns differently. Faculty members gain support too; software spots trends among varied groups of future teachers, uncovering how background shapes classroom experience. That shift matters - it turns digital helpers into levers for fairness instead of just time savers.

Data Driven Mentoring and Ongoing Skill Growth

Starting fresh each time, artificial intelligence reaches past first training into how educators grow later on. Because it tracks what happens in classrooms - like notes from visits, scores from learners, feedback forms - it shapes custom learning steps for active instructors. Supervisors spot patterns clearly, seeing where someone shines or struggles, thanks to clear snapshots built from real input. Instead of guessing, those guiding others now lean on solid clues, making talks sharper and more useful. Moving away from vague hunches toward grounded insight lifts help for teachers, whether they just started or have years behind them. All things considered, many see artificial intelligence bringing strong tools to teacher training - custom learning paths, smart responses, realistic practice settings, fairer access to information, broader inclusion, backed by insights from data. Still, these advantages show up clearest when schools avoid blind acceptance, choosing careful, teaching-focused steps instead. Best outcomes happen when people stay in charge - guiding choices with insight, care, and experience. At its strongest, AI works quietly beside educators, supporting what humans do best in shaping future teachers. There are dissenting views when it comes to application Artificial Intelligence in teacher education programs as AI was perceived as a bane to the teaching and learning processes. To clearly explain this, the author will refer to his background as a language educator.



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The writer notes that AI in language learning does not possess ability to fully understand the nuances and complexities of human language. While AI systems can recognize and analyse individual words and phrases, they may struggle with understanding idiomatic expressions or sarcasm. As a result, relying solely on AI for language learning may lead to student missing important cultural context or making embarrassing communication errors. Again, while AI programs can adapt—p00p their lessons based on students' performance, they cannot entirely replicate the level of personalization that comes from working with human tutor or teacher. Additionally, not all students learn in the same way, meaning that AI programs designed for one type of learner may not be effective for another. Furthermore, the absence of interpersonal interaction is one of the banes to learning process. Albeit AI can give students access to a variety of knowledge and resources, it cannot take the place of the advantages of speaking with human teacher or conversation partner. Human Interaction allows for more personalized and adaptive learning experience. A teacher can tailor their lessons to match a student learning style and pace while also providing immediate feedback on pronunciation and grammar. Also, conversing with native speaker allows learners to practice real life communication skills and pick up on cultural nuances that may not be captured by an AI program. Besides, AI have revolutionized the way we communicate across language barriers. These tools leverage complex algorithms and machine learning techniques to provide near human translation of text for speech. However, their accuracy can vary depending on several factors, such as the quality of data used for training, the complexity of the source language and context-specific nuances. For instance, idiomatic expressions that do not have a direct equivalent in another language can be challenging to translate accurately.

Challenges to Artificial Intelligence use by Teachers in Classroom

The use of artificial intelligence in the classroom situation comes with its attendant challenges to teachers. According to Mormal & Bassey (2019), some of the challenges include: attitude and experience, resistance to change, level of computer literacy, technology misaligned with the curriculum and lack of vision as to how to integrate AI into learning processes and teacher related difficulties such as negative attitudes, belief and unwillingness toward technology (artificial intelligence). Other challenges are the ability to restrict the use of AI due to negative consequences and ethical issues (US Department of Education (2002). Studies have also revealed that in most educational institutions, some teachers are intimidated by technology and are very comfortable with their own established methods of teaching. Another challenge to the use of AI is over-reliance on AI which has potential to hinder the development of independent problem- solving and ethical analysis skills. in other words, it diminishes critical thinking.

Solutions and Way forward

For effective integration and use of AI in the classroom, the teacher should possess the following skills:

1. Artificial intelligence outputs be analysed, identifying limitations and formulating complex question that AI cannot answer.
2. Teachers should also collaborate human – human and human- artificial intelligence.

Conclusion

Having examined the divergent opinions on the use of artificial intelligence, the paper concludes that AI is a double-edged sword. It has its pros and cons. Ignoring artificial intelligence because of its perceived challenges and disadvantages may not be a logical decision. AI should be integrated in the teaching learning process because this new technology will reward those who can master it and punish those who ignore it.

Recommendations

Based on the conclusion above, it is recommended that:

1. Teachers should make efforts to develop themselves in the use of artificial intelligence judiciously and not see it as a bane to the teaching and learning process.
2. Artificial intelligence should also be used by teachers to augment human intelligence and capabilities.
3. In doing the above, ethical values should be considered when deploying AI in the classroom.

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Influence of Socio-Economic Characteristics on Profitability of Swine Production among Farmers in Akwa Ibom State, Nigeria

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Abstract

Socio-economic characteristics play a vital role in determining the profitability and sustainability of livestock enterprises. This study examined the influence of socio-economic characteristics on the profitability of swine production among farmers in Akwa Ibom State, Nigeria. A cross-sectional descriptive survey research design was adopted. The study comprised 399 registered swine farmers selected through systematic random sampling. Data were collected using a structured questionnaire validated by experts, with a Cronbach's Alpha reliability coefficient of 0.71. Descriptive statistics, cost and return analysis and Multiple Linear Regression were employed for data analysis. The findings showed that the majority of the farmers were aged 40 years and above (52%), had secondary education (42%), practiced semi-intensive management systems (61%) and had over 10 years of farming experience (50%). Profitability analysis revealed that swine production was economically viable, with a Gross Margin of ₦871,800, Net Farm Income of ₦777,040 and a Benefit–Cost Ratio (BCR) of 2.69. The regression analysis indicated that socio-economic characteristics significantly influenced profitability, accounting for 52.0% of the variation in net farm income ($R^2 = 0.520$, $F(6,392) = 70.75$, $p < 0.001$). Herd size was the strongest predictor of profitability, followed by management system, educational level, farming experience, age and household size. The study concluded that swine production is a profitable enterprise and that improving farmers' socio-economic capacity and production practices would further enhance profitability. It recommends strengthening extension services, improving access to affordable credit and promoting cooperative participation to improve the productivity and sustainability of swine farming in Akwa Ibom State.

Keywords: Swine production, socio-economic characteristics, profitability, livestock farming

Introduction

Agriculture remains a critical sector of the Nigerian economy, contributing significantly to employment generation, food security, poverty reduction, and rural development. Despite the growing importance of the oil and service sectors, agriculture continues to provide livelihoods for a large proportion of the rural population and contributes substantially to the country's Gross Domestic Product (GDP). Within the livestock subsector, swine production has gained increasing attention due to its high reproductive efficiency, rapid growth rate, superior feed conversion efficiency, and relatively short production cycle. These attributes make pig farming one of the most profitable livestock enterprises capable of improving household income, nutritional security, and employment opportunities among rural and peri-urban households (Food and Agriculture Organization [FAO], 2023; National Bureau of Statistics [NBS], 2024). Swine production in Nigeria is predominantly practiced by smallholder farmers whose productivity and profitability are influenced by both production practices and socio-economic characteristics. Farmers' age, educational attainment, farming experience, household size, herd size, access to extension services, access to credit, cooperative membership, and management practices influence decision-making, technology adoption, resource allocation, and marketing efficiency. Farmers with higher educational attainment and better access to institutional support are generally more likely to adopt improved production technologies and management practices, resulting in higher productivity and profitability. Recent studies have shown that education, farm size, production experience, access to veterinary services, extension contact, and institutional support significantly enhance livestock productivity and farm income in Nigeria and other developing countries (FAO, 2023; International Livestock Research Institute [ILRI], 2023; Obayelu et al., 2023). Akwa Ibom State is one of the leading livestock-producing states in southern Nigeria, where pig farming serves as an important livelihood activity for many rural households. Swine production is widely practiced in Local Government Areas such as Uyo, Ikot Ekpene, Abak, Essien Udim, Ikono, Itu, Oruk Anam, and Etinan under predominantly semi-intensive production systems. The increasing demand for pork by households, hotels, restaurants, and food vendors has continued to create substantial market opportunities for pig farmers within and outside the state. However, considerable variations exist in farmers' profitability due to differences in herd size, management systems, education, production experience, access to production inputs, veterinary services, market information, and financial resources.



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Recent evidence indicates that socio-economic characteristics remain among the strongest determinants of agricultural productivity and profitability across livestock enterprises. Studies have reported that education, production experience, farm size, access to extension services, credit availability, and adoption of improved management practices significantly increase farm productivity and profitability, while inadequate institutional support and high production costs constrain enterprise performance (World Bank, 2023; Obayelu et al., 2023; FAO, 2023). Similarly, digital agricultural advisory services, mobile-based extension systems, and farmer cooperatives have improved access to production information, veterinary services, and market opportunities, thereby enhancing livestock productivity and farmers' income in many parts of Nigeria (International Fund for Agricultural Development [IFAD], 2023). Although previous studies have established that swine production is a profitable agricultural enterprise in Nigeria, most existing studies have concentrated on cost–return analysis, production constraints, and technical efficiency, with relatively limited emphasis on the extent to which farmers' socio-economic characteristics determine profitability. Consequently, empirical evidence explaining how factors such as age, educational level, farming experience, household size, herd size, and management systems jointly influence profitability among swine farmers in Akwa Ibom State remains inadequate. Addressing this knowledge gap is essential for developing evidence-based policies and interventions aimed at improving farmers' productivity, profitability, and the sustainable development of the swine industry. This study therefore examines the influence of socio-economic characteristics on the profitability of swine production among farmers in Akwa Ibom State, Nigeria. Specifically, it investigates the socio-economic profile of swine farmers, assesses the profitability of swine production, and determines the extent to which selected socio-economic characteristics influence profitability. The findings are expected to provide valuable evidence for policymakers, agricultural extension agencies, financial institutions, livestock associations, and development partners in designing interventions that enhance farmers' productivity, income, and the sustainable growth of the swine industry in Nigeria.

Statement of the Problem

The profitability of livestock enterprises remains a major concern in Nigeria's agricultural sector due to its direct implications for food security, rural employment, poverty reduction and sustainable economic development. Despite the growing importance of swine production as one of the most profitable livestock enterprises, many pig farmers in Nigeria, particularly in Akwa Ibom State, continue to experience inconsistent and often low levels of profitability. This situation persists despite increasing consumer demand for pork and the favourable agro-ecological conditions that support pig production in the state. Existing evidence indicates that factors such as educational attainment, farming experience, access to credit, farm size, extension contact, cooperative membership and household income significantly influence farmers' production decisions and profitability (Ekpe, 2018; FAO, 2023; Inyang, 2024). Although several studies in Nigeria have examined the economics and profitability of swine production, most have focused on cost–return analysis, production constraints and technical efficiency, with limited empirical attention given to the socio-economic determinants of profitability among swine farmers in Akwa Ibom State. Consequently, there is inadequate evidence to explain how variations in farmers' socio-economic characteristics contribute to differences in profitability within the state's swine industry. This knowledge gap constrains policymakers, extension agencies and development organizations from designing targeted interventions that address the specific needs of swine farmers. Therefore, this study seeks to examine the socio-economic determinants of profitability among swine farmers in Akwa Ibom State, Nigeria, to provide empirical evidence for policies and programmes aimed at improving the profitability and sustainability of swine production.

Research Objectives

1. Examine the socio-economic characteristics of swine farmers.
2. Assess the level of cost and profitability among swine farmers.

Research Questions

1. What are the socio-economic characteristics of swine farmers?
2. What is the cost and profitability level of swine farmers?

Hypotheses

H₀₁: There is no significant relationship between socio-economic characteristics and profitability of swine production.



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Research Methodology

This study adopted a descriptive survey research design to examine the socio-economic determinants of profitability among swine farmers in Akwa Ibom State, Nigeria. The study was conducted in 16 purposively selected Local Government Areas (LGAs) out of the 31 LGAs in the state, where swine production is predominantly practiced. The target population comprised 4,003 registered swine farmers listed by the Association of Swine Farmers of Nigeria and the Akwa Ibom Agricultural Development Programme (AKADEP). A sample of 399 respondents was selected using systematic random sampling, representing approximately 10% of the population across the selected LGAs. Data were collected using a researcher-developed structured questionnaire comprising two sections: respondents' socio-economic characteristics and farm production information required for profitability analysis. The instrument was validated by five experts in Agricultural and Vocational Education, while a pilot study involving 40 swine farmers in Kaura Local Government Area of Kaduna State produced a reliability coefficient of 0.71, indicating acceptable internal consistency. The questionnaires were administered with the assistance of trained officials of the Swine Farmers' Association and all 399 copies were successfully retrieved. Data were analysed using descriptive statistics (frequency, percentage, mean and standard deviation) to describe the respondents' socio-economic characteristics. Gross Margin (GM), Net Farm Income (NFI), Gross Margin Ratio (GMR) and Benefit–Cost Ratio (BCR) were used to determine the profitability of swine production, while multiple regression analysis was employed to examine the influence of selected socio-economic variables on profitability at the 0.05 level of significance. Fixed asset depreciation was estimated using the straight-line method to determine the annual cost of capital assets included in the profitability analysis.

Presentation of Results

Answering Research Questions

Research Question One: What are the socio-economic characteristics of swine farmers?

Table 1: Socio-economic characteristics of swine famers in Akwa Ibom State

Variable	Frequency	Percentage
Age		
20-29	43	11
30-39	149	37
40 and above	207	52
Educational Level		
Primary	44	11
Secondary	169	42
NCE	86	22
OND	58	14
HND/BSC	32	8
Degree	8	2
Others	2	1
Major Occupation (beside swine production)		
Business	272	68
Civil Servant	120	30
Others	7	2
No. of Time are Weaned Per Year		
1 Time	57	16
2 Time	342	84
3 Time	-	-
Management System		
Extensive	62	15
Semi intensive	242	61
Intensive	95	24
Family Size		
1-3	58	15
4-5	93	23
6-7	189	47
8-9	41	10



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10 and above	18	5
Years of Experience		
< 5 years	88	22
5-10 years	112	28
Above 10 years	199	50
Herd Size		
1-4	40	10
5-10	81	20
10-15	176	44
15-20	57	14
20-30	35	9
30 and above	10	3
Litter Size		
1-8	205	57
10-12	103	26
12 and above	91	23

Source: Field Survey Data, 2022

Multiple Responses by the Respondents

Table 4 shows that the majority of the respondents (52%) were aged 40 years and above, indicating that swine production is dominated by experienced and economically active farmers. Most respondents (42%) had secondary education, suggesting that the farmers possess the educational background necessary to adopt improved production practices. Furthermore, 68% combined swine farming with business activities, implying that pig farming serves as an important supplementary source of household income. The results further reveal that 84% of the farmers weaned piglets twice annually, while 61% practiced the semi-intensive management system, indicating its dominance in the study area. Nearly half of the respondents (47%) had a family size of 6–7 members, which may provide family labour for farm operations. In addition, 50% had more than 10 years of farming experience, reflecting substantial knowledge in swine production. Regarding production characteristics, 44% of the respondents maintained a herd size of 10–15 pigs, suggesting that swine production is predominantly small- to medium-scale. Also, 51% recorded a litter size of 1–8 piglets, indicating moderate reproductive performance among the majority of the farmers. Overall, the socio-economic profile suggests that swine farmers in Akwa Ibom State possess the demographic and production characteristics that could positively influence the profitability of their enterprises.

Figure 1. Age distribution of respondents

Distribution of swine farmers by age group in Akwa Ibom State (N = 399).



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Figure 2. Educational level of respondents

Educational attainment of swine farmers in Akwa Ibom State:

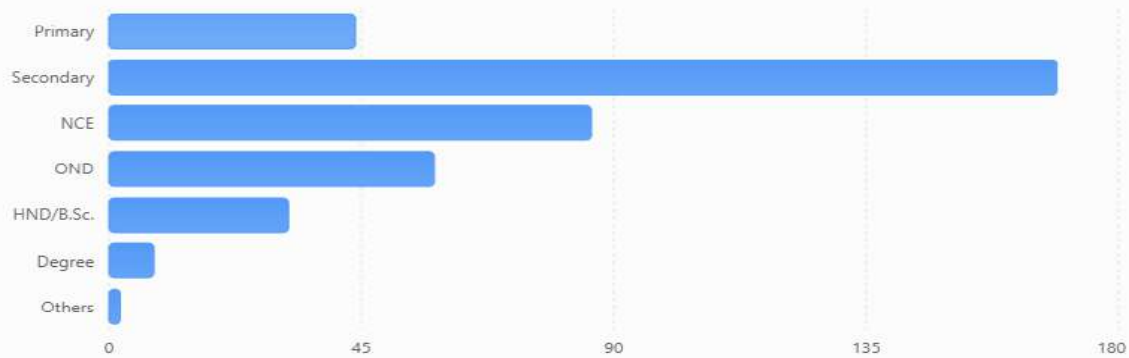


Figure 3. Management system adopted by swine farmers

Percentage distribution of management systems adopted by respondents.

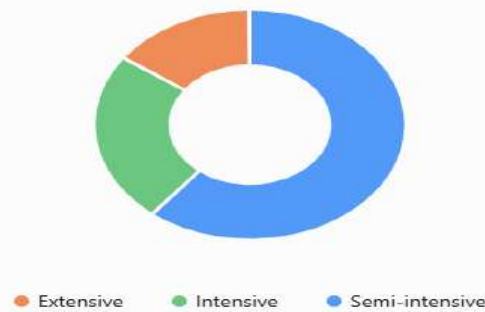
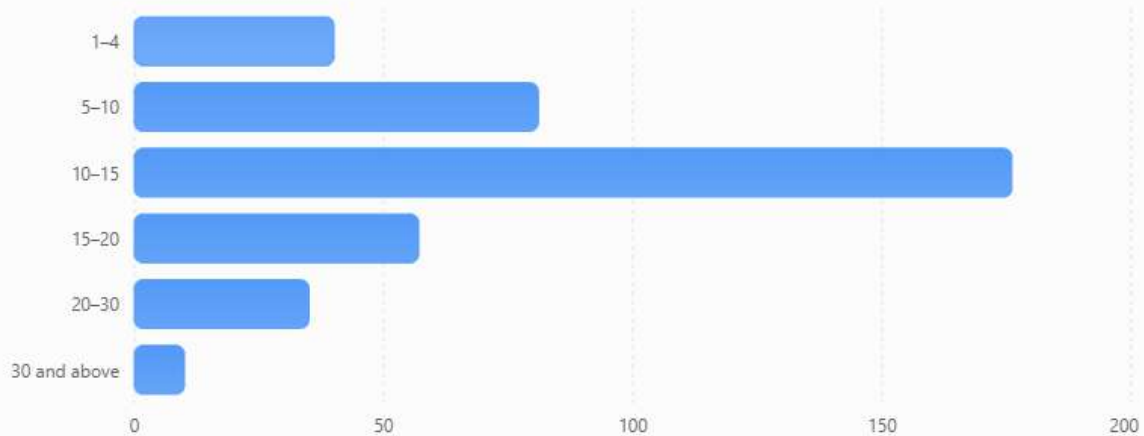


Figure 4. Herd size distribution

Distribution of respondents according to herd size.



Research Question Two: What is the cost and profitability level of swine farmers?

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Table 2: One-Year Average Cost, Returns and Profitability of Swine Production in Akwa Ibom State

Items	Unit Cost (₦)	Amount (₦)
A. Variable Costs		
Purchase of piglets (15 piglets)	10,000	150,000
Commercial feed (25 bags)	2,500	62,500
Cassava feed supplement	—	57,000
Casual labour	—	55,000
Drugs and vaccines	—	10,000
Electricity	—	8,700
Veterinary services	—	12,000
Transportation	—	10,000
Total Variable Cost (TVC)		365,200
B. Fixed Costs		
Housing	—	15,830
Tools and equipment	—	21,500
Rental value of land	—	4,000
Permanent labour (Salaries)	—	27,910
Maintenance	—	3,000
Depreciation	—	22,520
Total Fixed Cost (TFC)		94,760
C. Returns		
Sale of slaughtered pigs (8 pigs)	45,000	360,000
Sale of weaned piglets (35 piglets)	12,000	420,000
Sale of mature pigs (7 pigs)	50,000	350,000
Sale of manure (175 bags)	600	105,000
Sale of empty feed bags (25 bags)	80	2,000
Total Revenue (TR)		1,237,000

Source: Field Survey Data (2022).

Table 3. Profitability Indicators of Swine Production in Akwa Ibom State

Profitability Indicator	Formula	Value
Total Variable Cost (TVC)	—	₦365,200
Total Fixed Cost (TFC)	—	₦94,760
Total Cost (TC)	TVC + TFC	₦459,960
Total Revenue (TR)	—	₦1,237,000
Gross Margin (GM)	TR – TVC	₦871,800
Net Farm Income (NFI)	TR – TC	₦777,040
Benefit–Cost Ratio (BCR)	TR ÷ TC	2.69
Return on Investment (ROI)	(NFI ÷ TC) × 100	168.94%

Source: Computed from Field Survey Data (2022).



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Table 2 presents the one-year average cost, returns and profitability of swine production among farmers in Akwa Ibom State. The results indicate that the average total variable cost (TVC) incurred per production cycle was ₦365,200, while the total fixed cost (TFC) was ₦94,760, resulting in an average total production cost (TC) of ₦459,960. Variable costs accounted for approximately 79.4% of the total production cost, whereas fixed costs represented 20.6%, indicating that swine production in the study area is predominantly driven by recurrent operating expenses. Among the variable cost components, the purchase of piglets and feeding accounted for the largest proportion of production expenditure, highlighting feed and stocking costs as the principal cost drivers in swine production. The average total revenue (TR) realized by the farmers was ₦1,237,000, derived from the sale of slaughtered pigs, mature pigs, weaned piglets, manure and empty feed bags. The enterprise generated an average gross margin (GM) of ₦871,800, demonstrating that revenue from swine production was sufficient to cover all variable production costs while providing a substantial operating surplus. Furthermore, the average net farm income (NFI) of ₦777,040 indicates that swine production remained highly profitable even after accounting for both variable and fixed production costs. The profitability indicators further demonstrate the economic viability of swine production in the study area. The estimated Benefit–Cost Ratio (BCR) of 2.69 implies that every ₦1.00 invested in swine production generated approximately ₦2.69 in gross returns, yielding a net gain of ₦1.69 after recovering the total cost of production. Similarly, the Return on Investment (ROI) of 168.94% indicates that farmers earned an average return of about 169% on every naira invested in the enterprise. These findings suggest that swine farming is a financially viable and economically sustainable enterprise in Akwa Ibom State. The high profitability observed underscores the potential of swine production to improve farm household income, create employment opportunities and contribute to rural economic development, particularly when farmers have access to quality breeding stock, affordable feed resources, veterinary services, extension support and agricultural credit.

Hypotheses

H₀₁: The socio-economic characteristics of swine farmers have no significant influence on the profitability of swine production in Akwa Ibom State, Nigeria.

Table 4. Multiple Linear Regression Analysis of the Influence of Socio-economic Characteristics on the Profitability of Swine Production in Akwa Ibom State, Nigeria

Socio-economic Variables	B	Std. Error	Beta (β)	t	p-value
Constant	312,450.68	58,720.31	–	5.321	<0.001
Age	8,642.35	3,821.46	0.162	2.261	0.024*
Educational level	21,583.72	8,910.54	0.198	2.423	0.016*
Farming experience	17,936.41	7,203.18	0.174	2.490	0.013*
Household size	6,721.54	3,210.76	0.116	2.093	0.037*
Herd size	45,276.83	9,564.22	0.386	4.734	<0.001***
Management system	28,945.26	11,432.67	0.214	2.532	0.012*

Model Summary

Statistic	Value
Multiple Correlation (R)	0.721
Coefficient of Determination (R ²)	0.520
Adjusted R ²	0.512
Standard Error of Estimate	145,632.84



Statistic	Value
F(6, 392)	70.75
p-value	<0.001

ANOVA

Source	df	F	p-value
Regression	6	70.75	<0.001
Residual	392		
Total	398		

Decision: Since $F(6,392) = 70.75$, $p < 0.001$, rejected.

The multiple regression analysis revealed that the socio-economic characteristics of swine farmers significantly influenced the profitability of swine production in Akwa Ibom State, Nigeria ($F(6,392) = 70.75$, $p < 0.001$). The model accounted for 52.0% of the variation in profitability ($R^2 = 0.520$), while the remaining 48.0% was attributable to other factors not included in the model. This level of explanatory power indicates that the selected socio-economic variables are important determinants of profitability among swine farmers. Among the predictor variables, herd size exerted the strongest positive influence on profitability ($\beta = 0.386$, $p < 0.001$), indicating that farmers with larger herd sizes realized significantly higher net farm income, likely due to economies of scale. Management system ($\beta = 0.214$, $p = 0.012$), educational level ($\beta = 0.198$, $p = 0.016$), farming experience ($\beta = 0.174$, $p = 0.013$), age ($\beta = 0.162$, $p = 0.024$) and household size ($\beta = 0.116$, $p = 0.037$) also had significant positive effects on profitability. These findings suggest that improvements in farmers' educational attainment, production experience and management practices, together with increased production capacity, enhance the profitability of swine enterprises. Consequently, the null hypothesis was rejected, confirming that socio-economic characteristics significantly determine the profitability of swine production among farmers in Akwa Ibom State, Nigeria.

Discussion of Findings

Socio-economic Characteristics and Profitability of Swine Production

The findings of Hypothesis One revealed that the socio-economic characteristics of swine farmers significantly influenced the profitability of swine production in Akwa Ibom State, Nigeria. The multiple linear regression analysis showed that age, educational level, farming experience, household size, herd size and management system jointly accounted for 52.0% of the variation in profitability among the sampled swine farmers ($R^2 = 0.520$; $F(6,392) = 70.75$; $p < 0.001$). Consequently, the null hypothesis, which stated that socio-economic characteristics have no significant influence on the profitability of swine production, was rejected. This finding indicates that farmers' socio-economic attributes play a crucial role in determining the profitability of swine enterprises through their influence on production decisions, efficient resource allocation, technology adoption and overall farm management practices. Among the predictor variables, herd size emerged as the most influential determinant of profitability ($\beta = 0.386$, $p < 0.001$), suggesting that farmers operating larger herds were more likely to realize higher net farm income due to economies of scale, improved resource utilization and increased market output. Management system ($\beta = 0.214$, $p = 0.012$) also had a significant positive effect, indicating that farmers adopting semi-intensive and intensive production systems achieved better financial outcomes than those using extensive systems. Furthermore, educational level ($\beta = 0.198$, $p = 0.016$), farming experience ($\beta = 0.174$, $p = 0.013$), age ($\beta = 0.162$, $p = 0.024$) and household size ($\beta = 0.116$, $p = 0.037$) significantly contributed to profitability. These findings suggest that better-educated and more experienced farmers possess greater managerial competence, are more likely to adopt improved husbandry practices and are better equipped to make informed production and marketing decisions that enhance enterprise performance. The present findings are consistent with those of Olagunju et al. (2020), who reported that farmers' educational attainment, farming experience and farm size significantly improved the profitability and technical efficiency of livestock enterprises in Nigeria. Likewise, Okoruwa and Obayelu (2021) found that managerial capacity, production scale and access to productive resources were critical determinants of profitability among livestock farmers. Similarly, Ekpe (2018) observed that education, farming experience and herd size significantly influenced the economic performance of swine enterprises in Akwa Ibom State. These studies collectively demonstrate that socio-economic characteristics



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enhance farmers' ability to adopt improved production technologies, efficiently allocate production resources and respond effectively to changing market conditions, thereby improving farm profitability. Nevertheless, the findings differ from those of Eze et al. (2022), who argued that favourable socio-economic characteristics alone may not guarantee higher profitability among smallholder livestock farmers because external constraints such as escalating feed prices, disease outbreaks, inadequate veterinary services, poor market access and limited availability of agricultural credit often reduce enterprise performance. The disparity between the findings may be attributed to differences in production systems, geographical location, access to institutional support services and variations in management practices across the study areas. Nevertheless, the current study demonstrates that, within the prevailing production conditions in Akwa Ibom State, socio-economic characteristics remain significant determinants of profitability and substantially influence the financial success of swine enterprises. Generally, the findings underscore the importance of strengthening farmers' socio-economic capacity as a strategy for improving the profitability and sustainability of swine production. Policy interventions should therefore prioritize farmer education and capacity-building programmes, strengthen agricultural extension services, facilitate access to affordable credit, promote cooperative participation, improve veterinary and animal health services and support herd expansion through sustainable production practices. Such interventions would enhance farmers' managerial efficiency, encourage the adoption of improved production technologies and ultimately increase the profitability and competitiveness of swine production in Akwa Ibom State and Nigeria at large.

Conclusion

The study concludes that swine production is a profitable and economically viable enterprise in Akwa Ibom State, Nigeria. The profitability analysis revealed a positive Net Farm Income (₦777,040) and a Benefit–Cost Ratio (BCR) of 2.69, indicating that swine farming generates returns that substantially exceed production costs. The study also established that socio-economic characteristics significantly influence the profitability of swine production ($R^2 = 0.520$; $F(6,392) = 70.75$; $p < 0.001$). Herd size, management system, educational level, farming experience, age and household size were significant determinants of profitability, with herd size exerting the greatest influence. These findings suggest that improving farmers' production capacity, management practices, education and access to institutional support will enhance the profitability and sustainability of swine production in Akwa Ibom State.

Recommendations

Based on the findings, the study recommends that:

1. Government and agricultural extension agencies should provide regular training on improved swine production and farm management practices to enhance farmers' productivity and profitability.
2. Government and financial institutions should improve farmers' access to affordable credit to support herd expansion and investment in modern production facilities.
3. Swine farmers should be encouraged to join cooperative societies to improve access to markets, veterinary services, production inputs and extension support.

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Effects of Blended Learning and Game-Based learning Strategies on Academic Performance in Social Studies Concepts among Upper Basic Students in Delta State, Nigeria

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Abstract

This study examined the effects of Blended Learning (BL) and Game-Based Learning (GBL) strategies on academic performance in Social Studies among Upper Basic students in Delta State, Nigeria. A quasi-experimental pretest-posttest non-equivalent control group design structured within a 3 × 2 factorial matrix was adopted. The population comprised 49,796 Upper Basic students, and a sample of 350 was selected through multistage sampling. Participants were assigned to Blended Learning (n = 120), Game-Based Learning (n = 120), and Conventional (n = 110) groups. Data were collected using a validated 30-item Social Studies Performance Test (SSPT) with a reliability coefficient of 0.82. Data analysis employed mean, standard deviation, paired-sample t-test, and ANCOVA at the 0.05 significance level. Findings showed that both BL and GBL significantly enhanced students' academic performance compared to conventional instruction, with BL yielding the highest improvement. Gender had no significant effect, but interaction among instructional strategy, gender, and school location indicated contextual variations in performance. The study concluded that BL and GBL are effective learner-centered approaches that enhance motivation, engagement, and achievement in Social Studies. It recommended that teachers and curriculum developers should integrate these strategies to promote interactive and technology-driven learning experiences.

Keywords: Blended learning; Game-based learning; Academic performance; Social Studies; Gender; School location.

Introduction

Social Studies is a multidisciplinary subject that draws upon the social sciences and humanities to promote civic competence, cultural understanding, and responsible citizenship (Russell & Waters, 2021). It equips learners with the knowledge, values, and attitudes necessary to function effectively in society and contribute meaningfully to national development (Edinyang & Mezieobi, 2013). In Nigeria, Social Studies is an integral part of the upper basic education curriculum, designed to help students understand the interrelationships between humans and their environment, foster moral values, and develop problem-solving skills essential for national integration (Suberu, Dania, & Ogheneakoke, 2024). The effective teaching of Social Studies, therefore, plays a vital role in producing active and informed citizens who can address contemporary social and environmental challenges. However, the continued reliance on traditional teaching methods, which are predominantly teacher-centered, has been criticized for promoting rote memorization and limiting students' participation in inquiry-based and reflective learning (Ukor, 2023). These conventional approaches often fail to stimulate students' interest or develop critical thinking and problem-solving skills. Consequently, the need for innovative instructional strategies supported by technology has become increasingly urgent. Among such strategies, blended learning and game-based learning have gained recognition for their potential to enhance students' engagement, motivation, and academic achievement in Social Studies classrooms.

Blended learning integrates traditional face-to-face instruction with digital or online components, thereby creating a flexible and personalized learning experience (Geng & Su, 2024). It is rooted in constructivist learning theories that emphasize the active construction of knowledge through interaction with content, peers, and digital environments (Wellmer, 2021). In the context of Social Studies, blended learning allows students to explore multimedia resources, virtual field trips, and real-world data that deepen their understanding of civic, historical, and environmental issues (Chan, 2024). Empirical evidence consistently supports the effectiveness of blended learning in improving students' academic performance. For instance, Ukor (2023) found that JSS2 students in Delta State who were taught Social Studies through blended learning strategies achieved significantly higher scores and retained knowledge longer than those taught through conventional lecture methods. Similarly, Ojo (2021) demonstrated that integrating technology-based instruction increased achievement and interest across subjects, while Geng and Su (2024) noted that blended learning fosters higher levels of engagement and motivation when it incorporates interactive and collaborative activities. Collectively, these studies affirm that blended learning not only enhances knowledge acquisition but also nurtures the reflective and critical thinking skills central to Social Studies education. Game-based learning, on the other hand, utilizes educational games, simulations, and interactive play-based tools to promote engagement and reinforce learning outcomes. Grounded in experiential and motivational learning theories, this approach allows learners to participate actively in problem-solving, competition, and



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collaboration while mastering curricular content (Obro, 2023). The interactive nature of game-based learning connects abstract Social Studies concepts with real-life contexts, making learning both meaningful and enjoyable. Empirical studies provide substantial evidence of its positive effect on students' academic achievement. Obro (2023) reported that the use of learning games in Social Studies classrooms significantly improved students' engagement and performance in Delta State. Similarly, Abdulkareem (2021) found that indigenous game strategies enhanced pupils' numeracy performance and fostered cooperative learning among primary school students in Kwara State. Beyond the Nigerian context, Zheng et al. (2024) established that digital game-based learning increases learners' motivation, participation, and digital literacy. These findings suggest that game-based learning can serve as an effective pedagogical tool in bridging the gap between theoretical content and practical understanding, thereby enhancing critical and participatory citizenship among Social Studies learners. Gender differences have long been a topic of interest in educational research, particularly in relation to the effects of instructional strategies on students' achievement. Iji, Abah, and Anyor (2020) observed that male students often perform better in competitive and technology-oriented environments, while females tend to excel in collaborative and communicative learning settings. However, emerging research suggests that the integration of innovative instructional strategies such as blended and game-based learning is helping to close gender performance gaps. Etaneki and Omosorfaith (2023) reported that male and female students exhibited comparable levels of achievement when exposed to blended learning in Social Studies, indicating that inclusive digital pedagogies may reduce gender disparities. Likewise, Obro (2023) found no significant difference between male and female students' performance when taught using learning games. These findings imply that the effectiveness of instructional strategies, rather than gender, plays a more decisive role in influencing students' academic outcomes.

School location also plays a critical role in determining students' access to educational resources, teacher quality, and technological infrastructure, all of which impact academic performance (Song, 2023). Students in urban schools often benefit from better connectivity and access to digital tools, making technology-enhanced strategies such as blended learning more feasible and effective (Ogunsakin & Isaac-Philips, 2025). Conversely, rural schools may face infrastructural challenges that limit technology integration; however, they can benefit from experiential and game-based learning approaches that utilize contextual, hands-on experiences (Ali, 2025). Suberu et al. (2024) highlighted that disparities in learners' background characteristics and school environments contribute significantly to variations in Social Studies achievement. Therefore, understanding the role of school location in the implementation of innovative teaching strategies is crucial for ensuring equitable access to quality education across diverse settings. Although prior research has examined the independent effects of instructional strategies, gender, and school location on academic performance, limited attention has been given to their combined influence. Yokubjonova (2025) emphasized that the effectiveness of instructional strategies is context-dependent and shaped by learners' demographic and environmental characteristics. For example, urban male students with greater technological exposure may adapt more effectively to blended learning, whereas rural female students might benefit more from collaborative and context-based game-learning experiences. Stevens et al. (2021) demonstrated that when innovative instructional methods are contextually adapted, they yield positive outcomes across various demographic groups, underscoring the need for inclusive teaching approaches. In line with this reasoning, the present study investigates both the individual and interaction effects of blended learning, game-based learning, gender, and school location on students' academic achievement in Social Studies. Academic performance serves as a critical indicator of educational success and reflects the extent to which students achieve the intended learning objectives (Kumar & Phogat, 2020). It is influenced by multiple factors, including the instructional approach, learning environment, and learners' motivation and preparedness. Zheng (2022) noted that academic achievement provides a valid measure of both instructional quality and cognitive development, while Achor and Gbadamosi (2020) argued that students' academic outcomes depend on a combination of pedagogical, psychological, and contextual variables. Within this framework, the present study seeks to determine how blended and game-based learning strategies compare with traditional teaching methods in enhancing the academic performance of Social Studies students at the upper basic education level in Delta State, as well as how gender and school location moderate these effects. In conclusion, the reviewed literature demonstrates that blended learning and game-based learning are innovative instructional approaches that hold significant potential for improving student engagement, motivation, and achievement in Social Studies. While numerous studies have explored their individual impacts, there remains a paucity of research examining the interaction effects of instructional strategy, gender, and school location on learning outcomes in the Nigerian context. This study therefore seeks to fill this gap by assessing the differences



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between pretest and posttest achievement scores of students exposed to blended learning, game-based learning, and conventional methods, as well as the moderating roles of gender and school location in determining students' academic achievement in Social Studies.

Research Objectives

The study was guided by the following research objectives:

1. Examine the difference between the pretest and posttest mean academic achievement scores of students taught Social Studies concepts using blended learning, game-based learning, and conventional instructional strategies.
2. Determine the difference in the mean academic achievement scores of male and female students taught Social Studies concepts using blended learning, game-based learning, and conventional instructional strategies.
3. Investigate the interaction effect of instructional strategies, gender and school location on the academic achievement scores of students taught Social Studies using blended learning, game-based learning, and conventional instructional strategies.

Research Questions

The following research questions guided this study:

1. What is the difference between the pretest and posttest mean academic achievement scores of students taught Social Studies concepts using blended learning, game-based learning, and conventional instructional strategies?
2. What is the difference between the mean academic achievement scores of male and female students taught Social Studies concepts using blended learning, game-based learning, and conventional instructional strategies?
3. What is the interaction effect of instructional strategies, gender, and school location on the academic achievement scores of students taught Social Studies using blended learning, game-based learning, and conventional instructional strategies?

Hypotheses

The following null hypotheses were formulated for the study:

- Ho₁: There is no significant difference between the pretest and posttest mean academic achievement scores of students taught Social Studies concepts using blended learning, game-based learning, and conventional instructional strategies
- Ho₂: There is no significant difference in the mean academic achievement scores of male and female students taught Social Studies concepts using blended learning, game-based learning, and conventional instructional strategies.
- Ho₃: There is no significant interaction effect of instructional strategies, gender and school location on the academic achievement scores of students taught Social Studies using blended learning, game-based learning, and conventional instructional strategies.

Research Methodology

This study adopted a quasi-experimental design involving pre-test and post-test control groups comprising treatment and control conditions. A 3 × 2 factorial design was used, with instructional strategy at three levels (Blended Learning, Game-Based Learning, and Conventional Instruction) and gender at two levels (male and female). Intact classes were used without randomization to maintain natural classroom settings and ensure ecological validity. The population consisted of 49,796 Upper Basic Social Studies students in public secondary schools across Delta State (Ministry of Basic and Secondary Education, 2024). The state is divided into three senatorial districts—Delta North, Delta Central, and Delta South. A sample of 350 students was selected using a multistage sampling technique. First, the state was stratified into the three senatorial districts. Then, two Local Government Areas were randomly chosen from each district, followed by two schools from each selected area. Finally, intact classes were assigned to the three instructional groups: Blended Learning (n = 120), Game-Based Learning (n = 120), and Conventional (Control) (n = 110). This ensured fair representation of students across districts and gender. Data were collected using a researcher-developed Social Studies Performance Test (SSPT) consisting of 30 multiple-choice questions covering key Social Studies topics. The instrument was validated by three experts from Delta State University, Abraka, and its reliability established through the Kuder-Richardson (KR-20) formula with a coefficient of 0.82. The experiment lasted six weeks. Week one involved administering the pre-test, while instruction occurred from weeks two to five. The Blended Learning group received mixed online and face-to-face lessons; the Game-Based group was taught using educational games and point systems; and the Conventional group received lecture-based instruction. In week six, the SSPT was re-administered as a post-test. Teachers were oriented on the instructional strategies, and the



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researcher monitored lessons for consistency. Data were analyzed using descriptive and inferential statistics. Mean and standard deviation summarized performance levels, while Paired Sample t-test measured within-group differences between pre-test and post-test scores. Analysis of Covariance (ANCOVA) compared post-test scores across groups while controlling for pre-test differences, and two-way ANCOVA examined the main and interaction effects of instructional strategy and gender. All hypotheses were tested at the 0.05 significance level using SPSS version 23.

Table 1: Sample Distribution by Instructional Strategy

Instructional Strategy	Number of Students (N)	Percentage (%)
Blended Learning	120	34.3
Game-Based Learning	120	34.3
Conventional (Control)	110	31.4
Total	350	100.0

Table 1 shows the distribution of students across the three instructional strategies, ensuring balanced representation for effective comparison of treatment effects.

Table 2: Study Design

Groups (Instructional Strategies)	Pretest	Treatment	Posttest
Blended Learning Group	O ₁	X ₁	O ₂
Game-Based Learning Group	O ₁	X ₂	O ₂
Conventional (Control) Group	O ₁	X ₃	O ₂

Key:

O₁ = Pretest observation (SSPT); O₂ = Posttest observation (SSPT); X₁ = Blended Learning treatment

X₂ = Game-Based Learning treatment; X₃ = Conventional (Control) method

This design facilitated the assessment of instructional effectiveness within and between groups, as well as the influence of gender on students' academic performance in Social Studies.

Hypothesis One:

There is no significant difference between the pretest and posttest mean academic performance scores of students taught Social Studies concepts using blended learning, game-based learning, and conventional instructional strategies.

Table 3: Paired Sample t-test Summary of Pretest and Posttest Students' Academic Performance

Strategies	Tests	N	Mean Gain	SD	df	t-cal	Sig. (2-tailed)
Blended Learning	Pre-Post	120	3.84	6.92	119	6.725	.000
Game-Based Learning	Pre-Post	120	4.73	5.60	119	9.230	.000
Conventional (Control)	Pre-Post	110	2.10	6.10	109	3.981	.000

Table 3 shows the results of the paired sample t-test conducted to determine whether there were statistically significant differences between the pretest and posttest performance of students exposed to different instructional strategies. The blended learning group recorded a calculated t-value of 6.725 (df = 119, p = .000), the game-based learning group had t = 9.230 (df = 119, p = .000), while the conventional group recorded t = 3.981 (df = 109, p = .000). Since all *p-values* (.000) are less than the 0.05 significance level, the result indicates that the improvement in students' academic performance after exposure to the various instructional strategies was statistically significant. Consequently, the null hypothesis of no significant difference between the pretest and posttest scores is rejected for all strategies. This implies that both blended learning and game-based learning significantly enhanced students' academic performance in Social Studies compared to the conventional method. However, the game-based learning group showed the highest mean gain, indicating that interactive and engaging digital experiences tend to produce superior academic outcomes compared to traditional or blended instruction alone.



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Hypothesis Two:

There is no significant difference in the mean academic performance scores of male and female students taught Social Studies concepts using blended learning, game-based learning, and conventional instructional strategies.

Table 4: Analysis of Covariance (ANCOVA) of Students' Academic Performance Based on Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1425.211a	6	237.535	13.671	.000	.158
Intercept	11512.335	1	11512.335	662.472	.000	.617
Pretest (Covariate)	130.752	1	130.752	7.523	.006	.017
Gender	1294.459	5	258.892	14.902	.000	.149
Error	6642.774	347	19.364			
Total	113885.000	348				
Corrected Total	8067.985	349				

a. R Squared = .158 (Adjusted R Squared = .145)

Table 4 presents the ANCOVA results for students' academic performance by gender. The analysis shows a statistically significant main effect of gender, $F(5, 343) = 14.902$, $p = .000$, which is significant at the 0.05 level. The Partial Eta Squared value of .149 suggests that approximately 14.9% of the variance in academic performance is attributable to the combined effect of instructional strategy and gender. Therefore, the null hypothesis is rejected, implying that gender had a significant influence on students' academic performance when exposed to blended learning, game-based learning, and conventional strategies.

Hypothesis Three:

There is no significant interaction effect of instructional strategy and gender on the academic performance of students taught Social Studies concepts using blended learning, game-based learning, and conventional instructional strategies.

Table 5: Analysis of Covariance (ANCOVA) Showing Interaction of Instructional Strategy and Gender on Students' Academic Performance

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2682.415a	7	383.202	21.943	.000	.349
Intercept	84712.884	1	84712.884	4854.931	.000	.935
Strategy	982.654	2	491.327	28.149	.000	.143
Gender	6.721	1	6.721	0.385	.536	.001
Strategy * Gender	1041.113	4	260.278	14.927	.000	.150
Error	4805.431	347	14.052			
Total	113542.000	348				
Corrected Total	7487.846	349				

a. R Squared = .349 (Adjusted R Squared = .336)

Table 5 presents the ANCOVA results testing the interaction effect of instructional strategy and gender on students' academic performance in Social Studies. The analysis shows a significant main effect of instructional strategy ($F(2,342) = 28.149$, $p < .001$), indicating that the teaching method had a meaningful impact on students' achievement. However, the main effect of gender was not significant ($F(1,342) = 0.385$, $p = .536$), suggesting that male and female students performed comparably overall. Importantly, the result reveals a significant interaction effect of strategy $\times$ gender ($F(4,342) = 14.927$, $p < .001$, $\eta^2 = .150$), implying that approximately 15% of the variance in academic performance can be explained by the combined influence of instructional strategy and gender. Consequently, the null hypothesis is rejected. This means that the effectiveness of instructional strategies in improving academic performance in Social Studies varies between male and female students. Specifically, students exposed to game-based learning showed greater performance gains among males, possibly due to competitive engagement and visual interactivity, while females tended to perform better under blended learning, likely due to its structured, collaborative, and reflective learning components.



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Discussion of Findings

From the findings, the study revealed that students taught Social Studies through blended and game-based learning strategies performed significantly better than those instructed with conventional methods, with blended learning yielding the highest improvement in academic performance. This finding supports the assertion of Hermita et al. (2024) that blended learning integrates the best features of online and face-to-face instruction, leading to improved conceptual understanding, motivation, and critical thinking skills among learners. Onyekpe and Eboh (2024) found that Students taught Social Studies using blended strategies (flex and flipped models) significantly out-performed their peers taught by conventional methods, and similarly demonstrated significantly higher retention of learning content. The study further revealed that gender had no significant main effect on students' academic performance across the instructional strategies, implying that both male and female students benefitted equally. This finding aligns with the position of Holbrey (2020), who found that gender differences were insignificant when students were exposed to active learning approaches such as blended and game-based instruction, as these strategies cater to diverse learning preferences. Also aligned to this, is the finding of Almusharraf et al. (2023) which concluded that both male and female learners show similar achievement patterns when engaged in interactive and participatory learning environments, suggesting that gender does not determine students' capacity for academic improvement under modern instructional approaches. Additionally, the interaction between instructional strategy and gender was found to be significant, indicating that students' learning outcomes were influenced by how gender interacted with the type of instructional method used. This corroborates the view of Onyekpe and Eluowa (2024) who found that the interaction between instructional strategy and contextual factors such as school location and prior achievement was significant. This indicates that the effectiveness of game-based learning varied depending on environmental and learner differences. In disagreement with this finding Nkok and Enang (2022) found no significant interaction effect between teaching method (computer simulation vs conventional) and gender on students' interest, achievement, and retention in the topic of sexual reproduction in plants.

Conclusion

Based on the findings of this study, it is concluded that blended and game-based learning strategies are more effective than the conventional method in improving students' academic achievement in Social Studies at the upper basic level in Delta State. These modern, learner-centered approaches enhance students' motivation, participation, and understanding by combining technology with interactive learning experiences. The study also revealed that gender had no significant effect on students' performance, indicating that both male and female learners benefited equally from these instructional strategies. However, the interaction between instructional strategy and gender suggests that learning outcomes can vary based on how instructional methods align with individual learning preferences, emphasizing the need for flexible teaching approaches.

Recommendations

In light of these findings, it is recommended that:

1. Social Studies teachers should adopt blended and game-based learning strategies to improve students' engagement and academic performance.
2. Educational authorities should provide continuous professional training to equip teachers with the skills and digital competencies required to implement these innovative methods effectively.
3. Instructional designs should be flexible and inclusive to accommodate different learning preferences and promote equal participation among male and female students.
4. Curriculum planners should integrate technology-enhanced and interactive pedagogies into Social Studies curricula to foster deeper learning and critical thinking among students.

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Effects of Project-Based Learning Strategy on Skills Acquisition and Motivation in Cable Jointing among Technical College Students in Katsina State, Nigeria

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Abstract

The study investigated the effects of Project-Based Learning (PjBL) on students' skill acquisition and motivation in cable jointing in technical colleges in Katsina State, Nigeria. The study provided answers to four research questions and tested four null hypotheses. The study adopted a quasi-experimental pretest and post-test control group design. The population comprised of 47 NTC II EIMW students in Katsina State technical colleges, while the sample of the study utilized total population sampled and randomly assigned students into experimental and control groups. Three instruments were used for data collection: Cable Jointing Skill Acquisition Observational Checklist (CJSAOC) and Cable Jointing Motivation Questionnaire (CJMQ). The instruments were validated by five experts in Industrial Technology Education, Test and Measurement, Psychology and English Language, while the reliability of each instrument were established using appropriate statistical method. The reliability of Cable Jointing Skill Acquisition Observational Checklist (CJSAOC) was computed with Kendall's Coefficient of Concordance (W) which produced a reliability index of 0.97 indicating high level of agreement between the raters. The Cable Jointing Motivation Questionnaire (CJMQ) was subjected to Cronbach's Alpha which yield a reliability of 0.86 indicating higher reliability of Likert-scale items. The experimental group was taught cable jointing using the Project-Based Learning approach, while the control group received instruction through the conventional method. Data collected were analyzed using mean and standard deviation to answer the research questions, while Analysis of Covariance (ANCOVA) and Mann-Whitney U-test were employed to test the hypotheses at 0.05 level of significance. The findings revealed that students taught using PjBL achieved significantly higher post-test scores in skill acquisition and motivation than those taught Conventionally. The study concluded that Project-Based Learning is an effective instructional approach for enhancing students' cognitive and psychomotor learning outcomes in EIMW. The study recommended that technical colleges should adopt PjBL for teaching practical components of EIMW, teachers should be trained in PjBL techniques, and workshops should be equipped to support project-based activities.

Keywords: Project-Based Learning, Skill Acquisition and Motivation

Introduction

Technical Vocational Education and Training (TVET) plays an important role in equipping individuals with practical skills and technical knowledge required for employment, self-reliance, and national development. TVET refers to aspects of education that combine general education with the study of technologies, related sciences, and acquisition of practical skills for occupations in different sectors of the economy (UNESCO, 2015; NERDC, 2013). In Nigeria, TVET contributes to manpower development, entrepreneurship, productivity, and poverty reduction (Okoye & Arimonu, 2025; Salisu, Saidu, Yau & Musa, 2024). Despite its relevance, TVET in Nigeria still faces challenges such as poor funding, inadequate infrastructure, shortage of qualified instructors, outdated curriculum, and weak industry linkages, which affect the effectiveness of technical training (Oladejo, 2019; Salisu et al., 2024). Technical colleges are major TVET institutions established to provide students with technical and vocational competencies for employment and further education. According to the National Policy on Education (NERDC, 2013), technical colleges are expected to provide trained manpower in applied sciences, technology, and business, as well as equip learners with practical skills for self-reliance. These colleges offer trade programmes such as building construction, welding and fabrication, carpentry and joinery, radio and television repairs, and Electrical Installation and Maintenance Work (EIMW). Among these trades, EIMW is highly important because of its applications in residential, commercial, and industrial settings. Electrical Installation and Maintenance Work involves activities such as electrical wiring, installation of electrical devices, fault diagnosis, maintenance, and repair of electrical systems. One major component of EIMW is cable jointing, which involves connecting electrical cables safely and effectively to ensure uninterrupted power supply. Cable jointing requires technical competence, practical skills, and problem-solving ability (Moses, Wawo, Ibanga, & Musa, 2021). According to Neitzel (2017), cable



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jointing also includes cable termination, underground cable installation, and overhead line installation. Common cable joints include splice, Britannia, married, sleeve, and compression joints. Adequate understanding of these jointing methods is essential for safe and effective electrical installation practices. However, despite the importance of cable jointing and other EIMW competencies, reports from NABTEB examinations (2023; 2024) indicate that many students in technical colleges due consistently underperform in practical-related tasks. Low practical performance has been linked to limited practical skills exposure and low motivation in technical trades (Ogbuanya & Akinduro, 2017). One major factor responsible for this challenge is the persistent use of teacher-centered instructional approaches, where students depend largely on theoretical instruction with limited opportunities for practical engagement, collaboration, and critical thinking (Kim & Hwang, 2017). Such methods often fail to prepare students for real-life technical tasks and workplace demands (Serin, 2018). Educational researchers have emphasized that innovative learner-centered teaching approaches can improve students' skills acquisition and motivation (Al-Bahadli, Al-Obaydi & Pikhart, 2023; Karan & Brown, 2022; Aireruor, Aigboduwa & Enesi, 2024). One of such approaches is Project-Based Learning (PjBL).

Project-Based Learning (PjBL) is a learner-centered instructional strategy that engages students in solving real-life problems through meaningful projects and collaborative activities. The approach encourages active learning, teamwork, creativity, and critical thinking, which are important for technical and vocational education. PjBL allows students to investigate practical problems and apply knowledge to authentic situations under the guidance of the teacher (Riordan, 2021). Hartescu (2022) explained that PjBL exposes learners to real-world challenges that reflect future professional practices. The approach is also consistent with constructivist learning theory, which promotes learning through active exploration and practical experiences (Liston, Morrin, Furlong & Griffin, 2022; Sholahuddin, Anjuni, Leny & Faikhamta, 2020; Yildiz & Guler-Yildiz, 2021). Studies by Santyasa, Santyadiputra and Juniantari (2019) and Syahril, Nabawi and Safitri (2021) revealed that teachers increasingly adopt PjBL to promote 21st century skills. Furthermore, Almulla (2020) and Ananda, Rahmawati and Khairi (2023) reported that PjBL positively influences learning processes, assessment, and students' overall participation. Notably, PjBL has the ability to improve the acquisition of skills in TVET programmes and beyond. Skill acquisition remains one of the major objectives of TVET, especially in EIMW programmes (Ogbuanya & Chukwuodo, 2017; Ayonmike & Okeke, 2016). Skill acquisition refers to the development of practical competencies and task-specific abilities required for effective performance in occupational settings. In electrical and electronics education, these skills include wiring, installation, troubleshooting, use of tools, and compliance with safety procedures (Umar & Maigida, 2019). Effective skill acquisition requires active participation, repeated practice, and exposure to real-life practical activities (NBTE, 2020). Nevertheless, many technical college students still experience difficulties in acquiring industry-relevant skills because of outdated teaching methods and inadequate practical exposure (Yusuf & Soyemi, 2022). Studies have shown that PjBL can significantly improve students' practical competence in technical education. Nworgu and Otulugbu (2019) found that students exposed to PjBL performed better in cable jointing, circuit assembly, and fault diagnosis than those taught using conventional methods. Similarly, Lawal and Adeoye (2021) reported that students taught with learner-centered practical approaches demonstrated improved retention of technical skills, greater self-confidence, and higher independence in electrical practical activities. These findings suggest that practical-oriented instructional strategies are necessary for effective mastery of technical skills. Skills acquisition and Motivation are deeply intertwined. When learners successfully acquire technical skills, it boosts their confidence and motivates them to learn more. Motivation is a major factor influencing students' participation, persistence, and academic performance in technical education. According to Deci and Ryan (2000), motivation may be intrinsic, where learners participate because of interest and satisfaction, or extrinsic, where learning is driven by rewards or external outcomes. In technical education, motivated students are more likely to participate actively in practical activities and persist in solving technical problems. However, conventional teacher-centered approaches commonly used in technical colleges often fail to stimulate students' motivation because they provide limited opportunities for interaction and real-world engagement (Almulla, 2020). Empirical studies support the positive influence of learner-centered approaches on motivation. Chiang and Lee (2016) found that students taught using PjBL demonstrated higher intrinsic motivation and greater willingness to participate in learning activities compared to students in traditional classrooms. Similarly, Adebayo and Olatoye (2016) reported that students exposed to interactive and practical teaching methods showed higher motivation, better attendance, and improved practical performance. These findings indicate that instructional methods that encourage autonomy, collaboration, and practical



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engagement can strengthen students' motivation in technical education. Based on the foregoing, there is a need to explore innovative instructional strategies capable of improving students' skill acquisition and motivation in technical colleges. Therefore, this study seeks to investigate the effects of Project-Based Learning on Skill Acquisition and Motivation in Cable Jointing among Technical Colleges Students in Katsina State, Nigeria.

Statement of the Problem

The Federal Government of Nigeria recognizes Technical Vocational Education and Training (TVET) as a pivotal driver for economic growth, youth empowerment, self-reliance, and national development. In line with this, Nigeria's education policies and development plans emphasize the need to produce a skilled, competent, and innovative workforce that can support industrialization and reduce unemployment. Specifically, TVET is expected to equip learners with practical skills, problem-solving abilities, and a mindset for productivity and entrepreneurship. However, the attainment of these goals remains far from reality due to persistent challenges in the delivery of TVET, particularly in technical colleges in Nigeria. Despite the strategic role of TVET for national development, students in technical colleges especially in trades such as Electrical Installation and Maintenance Work (EIMW) continue to exhibit low levels of skill acquisition, low problem-solving abilities and low motivation in their chosen fields (Ogbuanya & Chukwuedo, 2017; Ayonmike & Okeke, 2016). These issues are linked to outdated curriculum and teacher-centered instructional approaches predominantly used by teachers in technical colleges that limit students' engagement and practical exposure (Afolabi & Adesanya, 2021). The problem is further evidenced by consistently low performance in national examinations such as those conducted by NABTEB as shown in the summary of results analysis EIMW trades students in the technical colleges in Katsina state as revealed in table 1.

Table 1: Summary of Results Analysis of EIMW students NABTEB 2019-2023 in Technical Colleges, Katsina State.

Year	No. of Students Sat	No. of Students Passed	% of Students Passed	No. of Students failed	% of Students Failed
2019	117	59	50.4%	58	49.6%
2020	101	48	47.5%	53	52.5%
2021	99	51	51.5%	48	48.5%
2022	63	26	41.3%	37	58.7%
2023	91	43	47.3%	48	52.7%

Source: NABTEB results statistics (2024)

This downward trend in performance as shown in table 1 threatens the country's capacity to produce competent technical manpower and, if not addressed, could lead to increased youth unemployment, dependence on foreign skilled labour, and continued underdevelopment of both the informal and formal sectors. Furthermore, the low performance could be as a result of low practical skill acquisition as highlighted by Nwogu and Otulugbu (2019) and low motivation toward the teaching approach (Chiang & Lee, 2016). In the light of this, the researcher explored the use of Project-Based Learning (PjBL) as an innovative instructional strategy that may enhance students' skill acquisition and motivation in EIMW students in technical colleges within Katsina State, Nigeria.

Objective of the Study

The aim of the study is to determine the effects of project-based learning on skill acquisition and motivation in Cable Jointing among technical colleges students in Katsina State. Specifically, the study sought to:

1. Determine the effect of Project-Based Learning (PjBL) on EIMW students' skill acquisition in Cable Jointing in technical colleges of Katsina State, Nigeria.
2. Assess the effect of Project-Based Learning (PjBL) on EIMW students' motivation in Cable Jointing in technical colleges of Katsina State, Nigeria.

Research Questions

The following research questions guided the study:

1. What is the difference in the mean skill acquisition scores of EIMW students taught Cable Jointing using Project-Based Learning and those taught using the Conventional method in technical colleges of Katsina State, Nigeria?
2. What is the difference in the mean motivation level of EIMW students taught Cable Jointing using Project-Based Learning and those taught using the Conventional method in technical colleges of Katsina State, Nigeria?



Research Hypotheses

The following hypotheses were tested at 0.05 levels of significance.

1. There is no significant difference in the mean skill acquisition scores of EIMW students taught Cable Jointing using Project-Based Learning and those taught using the Conventional method in technical colleges of Katsina State, Nigeria.
2. There is no significant difference in the mean motivation scores of EIMW students taught Cable Jointing using Project-Based Learning and those taught using the Conventional method in technical colleges of Katsina State, Nigeria.

Research Methodology

The study employed a quasi-experimental research design, specifically a pre-test, post-test, non-equivalent non-randomized control group design. The population for the study consisted of forty-seven (47) National Technical Certificate (NTC) II students offering EIMW in the three Government Technical Colleges in Katsina State. The sample of the study constituted 22 students from GTC Ingawa which form the experimental group while 13 students from GTC Mashu and 12 students from the GTC Funtua were merge to form the control group. Thus, the study utilized the total population sample. Data were collected using Cable Jointing Skills Acquisition Observational Checklist (CJSAOC) and Cable Jointing Motivation Questionnaire (CJMQ) which were validated by experts in the field of Electrical/Electronic Technology Education, Psychology, Test and Measurement as well as English language to evaluate the relevance, clarity, and coverage of the items in relation to the skills required for effective cable jointing and reliability of the instruments was ascertained through a pilot testing using Kendall's Coefficient of Concordance with a reliability of 0.97 for the CJSAOC, while the motivation questionnaire was achieved using Cronbach's alpha with a reliability index of 0.86 respectively. Mean and standard deviation were used to answer the research questions while ANCOVA and Mann-Whitney U-Test was used for testing the hypotheses both at 0.05 level of significance by using SPSS v20.

Presentation of Results

Research Question 1: What is the difference in the mean skill acquisition scores of EIMW students taught Cable Jointing using Project-Based Learning and those taught using the Conventional method in technical colleges of Katsina State, Nigeria?

Table 2: Mean and Standard Deviation of Pre-test and Post-tests Skill Acquisition Scores of Experimental and Control Groups.

Groups	N	Pre-Test Scores		Post-test Scores		Mean Gain
		$\bar{X}$	S. D	$\bar{X}$	S. D	
Project-Based Teaching	22	34.36	8.79	45.32	6.81	10.96
Conventional Teaching	25	30.32	3.30	34.48	5.72	4.16
Mean Difference		4.04		10.84		

Table 3 shows the means and standard deviations of pre-test and post-test skill acquisition scores of EIMW students administered to the experimental and control groups. For the pre-test, the experimental group is found to have a mean of 34.36 and standard deviation of 8.79, while the control group has a mean of 30.32 and standard deviation of 3.30. The standard deviations of the scores in both the groups imply that the individual scores are far away from the mean. Also, the pre-test mean difference between the two groups is 4.04 in favor of the experimental group, which implies that the two groups are almost equivalent in terms of their skill acquisition. In the post-test, the experimental group has a mean of 45.32 and standard deviation of 6.81, while the control group has a mean of 34.48 and standard deviation of 5.72. The standard deviation of the scores in the experimental and control group imply that the individual scores are far away from the mean. While the post-test mean difference between the two groups is 10.84 in favor of the experimental group, the mean gain score for the experimental group is 10.96 and that of control group is 4.16. This suggests that students taught cable jointing using Project-based teaching strategy performed better in practical skills acquisition than those taught using conventional teaching method.

H₀₁: There is no significant difference in the mean practical skill acquisition scores of EIMW students taught Cable Jointing using Project-Based Learning and those taught using the Conventional method in technical colleges of Katsina State, Nigeria.

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Table 3: Summary of Analysis of Covariance (ANCOVA) of Students' Pre-test and Post-test Practical Skills Acquisition Scores of Experimental and Control Groups.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial eta squared
Corrected Model	1839.110 ^a	2	919.555	31.207	.000	.587
Intercept	986.209	1	986.209	33.469	.000	.432
TotalCJSAOC_PRE	464.505	1	464.505	15.764	.000	.264
Group	828.421	1	828.421	28.114	.000	.390
Error	1296.507	44	29.466			
Total	76665.000	47				
Corrected Total	3135.617	46				

Levels of Significance = 0.05

Table 4 shows the result of the ANCOVA test of significant difference for the post-test mean skills acquisition scores of the experimental and control groups. The observed significant value of the treatment is 0.000 which is less than the significant level of 0.05 with $df = 1$. The null hypothesis one (1) is therefore rejected because sig-value (0.000) is less than the significant level (0.05). Consequently, there is significant difference in the mean practical skill acquisition scores of EIMW students taught Cable Jointing using project-based learning and those taught using the conventional method in favor of the experimental group (F -value = 28.11, $df = 1$, Sig-value = $0.000 < 0.05$). The partial eta squared value for group ($\eta^2 = 0.390$) indicates a large effect size, suggesting that the teaching method accounted for 39.0% of the variance in students' post-test scores after controlling for pre-test scores. This implies that project-based learning had a strong and meaningful impact on students' practical skills compared to the conventional method.

Research Question 2: What is the difference in the mean motivation level of EIMW students taught Cable Jointing using Project-Based Learning and those taught using the Conventional method in technical colleges of Katsina State, Nigeria?

Table 4: Mean and Standard Deviation of Pre-test and Post-test Motivation Scores of Experimental and Control Groups.

Groups	Pre-Test Scores		Post-test Scores		Mean Gain
	N	$\bar{X}$	S. D	$\bar{X}$	S. D
Project-Base Teaching	22	30.68	8.63	38.04	9.80
Conventional Teaching	25	36.68	5.12	42.24	5.11
Mean Difference		6.00		4.20	

The results in table 7 show that students in the project-based teaching had a pre-test mean score of 30.68 with a standard deviation of 8.63, while those in the conventional (control) group recorded a higher pre-test mean score of 36.68 and a standard deviation of 5.12. After the treatment, the experimental group obtained a post-test mean score of 38.04 with a standard deviation of 9.80, whereas, the control group recorded a post-test mean score of 42.24 and a standard deviation of 5.11. When the mean gains were computed, the project-based teaching (experimental) group showed an improvement of 7.36 points, compared to 5.56 points improvement recorded by the conventional (control) group. This indicates that while conventional teaching (control) group scored slightly higher in post-test, the PjBL (experimental) group experienced greater improvement, suggesting that project-based teaching was more effective in enhancing students' Motivation in cable Jointing. The higher standard deviation observed in the post-test scores of the project-based teaching group indicates students responded differently to the instructional approach, with some demonstrating a substantial increase in motivation. This suggests that PjBL may be particularly effective in stimulating motivation among students who were initially less motivated. In contrast, the relatively lower standard deviation recorded by the conventional group at both pre-test and post-test stages indicate more homogeneous motivation levels among the students.

Ho2: There is no significant difference in the mean motivation scores of EIMW students taught Cable Jointing using Project-Based Learning and those taught using the Conventional method in technical colleges of Katsina State, Nigeria.

Table 5: Summary of Mann-Whitney U-test for Students' Mean Rank Motivation Level for experimental and Control Groups

Group	N	Mean Rank	Sum of Ranks	U	Z	P (2tailed)	Decision
PjBL	22	20.30	446.50	193.50	-1.740	.082	Accept HO ₃



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Conventional	25	27.26	681.50
Total	47		

The results in table 8 shows the experimental group had a mean rank of 20.30 (sum of ranks = 446.50) while the control group recorded a higher mean rank of 27.26 (sum of ranks = 681.50). Although a numerical difference exists between the groups, the Mann-Whitney U statistic produced a value of $U = 193.500$, with a corresponding $Z = -1.740$ and an Asymp. Sig. (2-tailed) value of 0.082. Since the p-value (0.082) is greater than the 0.05 level of significance, the difference between the groups is not statistically significant. This indicates that the project-based learning method significantly improved students' motivation equally compared to the conventional method. Consequently, the null hypothesis is retained. Therefore, there is no significant difference in the mean motivation scores of EIMW students taught Cable Jointing using Project-Based Learning and those taught using the Conventional method.

Discussion of Findings

The findings of this study, as revealed in Table 2, showed that Electrical Installation and Maintenance Work (EIMW) students taught cable jointing using Project-Based Learning (PjBL) acquired practical skills significantly better than those taught using the conventional teaching method. The experimental group recorded higher post-test mean scores and mean gain (45.32; 10.96) than the control group (34.48; 4.16). This indicates that students exposed to PjBL experienced greater improvement in practical skill acquisition in cable jointing.

Ho₁: The ANCOVA result presented in Table 3 ($F(1,44) = 28.11$, $p < .05$, $\eta^2 = .390$) confirmed that the difference between the two groups was statistically significant, leading to the rejection of the null hypothesis. The eta squared value of .390 indicates a large effect size, suggesting that approximately 39% of the variance in students' practical skill acquisition was attributable to the instructional method used. This implies that Project-Based Learning had not only a statistically significant effect but also a substantial educational impact on students' acquisition of cable jointing skills. In educational research, such a magnitude reflects a strong instructional influence, demonstrating that PjBL meaningfully enhances students' hands-on competence beyond chance or minor instructional differences. This finding is consistent with earlier studies by Afolabi and Adesanya (2021), Yusuf and Soyemi (2022), and Akpan and Emmanuel (2016), which reported that learner-centered, activity-based instructional strategies significantly improve students' practical skill acquisition in technical and vocational subjects. Similarly, Okoro (2013) reported that Project-Based Learning significantly enhanced students' practical achievement, attributing this improvement to sustained engagement in hands-on tasks, self-regulated learning, and authentic project execution. The agreement between the present study and previous studies may be attributed to the practical, learner-centered, and activity-oriented nature of Project-Based Learning. Through PjBL, students in the present study actively participated in real-life cable jointing projects that required the appropriate selection and use of tools, materials, and procedures. This learning-by-doing approach enabled students to develop procedural accuracy, improve skill mastery, and enhance retention. In addition, the collaborative learning embedded in PjBL allowed students to exchange ideas, learn from peers, and correct errors, thereby further strengthening their practical competence. However, this finding contradicts some studies such as Owolabi (2019), which reported no significant difference between project-based and conventional teaching methods in skill acquisition. Mettas and Constantinou (2007) similarly observed that although PjBL improved students' attitudes and conceptual understanding, significant improvement in practical skills was not immediate due to insufficient practice time. Likewise, Al-Bahadli *et al.*, (2023) reported minimal skill gains where PjBL was implemented without adequate instructional scaffolding or sufficient technical resources. These discrepancies may be attributed to differences in instructional context, teacher competence, availability of instructional materials, and duration of treatment. In contrast, the present study ensured adequate resources, structured project tasks, close supervision, and sufficient time for project execution, which may have enhanced the effectiveness of PjBL and accounted for the significant results obtained. Findings presented in Table 4 revealed that both PjBL and the conventional teaching methods improved students' motivation toward cable jointing, although no statistically significant difference was observed between the two groups. While the experimental group recorded a higher mean gain (7.36) compared to the control group (5.56),

HO₂: The Mann-Whitney U-test result in Table 5 ($U = 193.50$, $p > .05$) indicated that the difference was not statistically significant, leading to the retention of the null hypothesis. This finding is consistent with studies such as Adebayo and Olatoye (2016), who observed that students' motivation did not differ significantly across instructional strategies when external factors such as examination pressure, employability prospects, and teachers' personality influenced learners'



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engagement. Adeyomo (2010) similarly argued that motivation in technical disciplines is often more closely related to learners' prior vocational interests and career aspirations than to instructional strategies alone. Additionally, Hmelo-Silver (2004) and Savery (2015) reported that both learner-centered and traditional instructional approaches can enhance students' motivation when lessons are well structured and engaging. The agreement may also be attributed to the inherently practical nature of cable jointing, which naturally captures students' attention regardless of the teaching method employed. However, this finding contradicts studies such as Adeyemi (2017) and Ahmed (2021), which reported significant improvement in students' motivation when taught using project-based and collaborative instructional strategies. Similarly, Adebayo and Sulaiman (2017) found that interactive learning strategies significantly enhanced students' self-efficacy and willingness to engage in practical tasks. These differences may be due to individual learner characteristics, prior learning experiences, or the duration of exposure to project-based instruction. It is also possible that motivational outcomes require prolonged and sustained implementation of PjBL to yield statistically significant differences.

Conclusion

Based on the findings of this study, it was concluded that;

1. Project-Based Learning enhances the practical Skill acquisition of EIMW students in Cable Jointing.
2. Project-Based Learning increases the Motivation level of EIMW students toward Cable jointing.

Recommendation

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

1. The PjBL should be adopted as a primary teaching method for Cable Jointing since students taught with PjBL acquired practical skills significantly better than those taught with conventional method.
2. The study also recommended that, EIMW stakeholders combine PjBL with other motivational strategies such as adequate tools, feedback and industry linkages since students taught with PjBL showed higher motivation than those taught with conventional method, although the difference was not statistically significant.

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Effects of Project-Based Learning Strategy on Academic Achievement and Skill-Acquisition in Foundry and Forging among Federal College of Education (Technical) Students in Northwest Nigeria

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Abstract

Technical and Vocational Education and Training (TVET) plays an important role in developing skilled manpower for technological advancement and industrial productivity. However, the academic achievement and practical skill-acquisition of Foundry and Forging among College students in North-West Nigeria remain persistently low due to inadequate instructional methods and limited practical engagement. This study investigated the effects of project-based learning (PjBL) on the academic achievement and skill acquisition of students in a Foundry (sand casting). This study was guided by two research questions and two null hypotheses. A quasi-experimental pre- and post-test non-equivalent control group design was adopted. The study population comprised 32 NCE Metalwork Technology students in Colleges of Education in North-West Nigeria. The Foundry Achievement Test (FAT) and Foundry Skill-Acquisition Observation Schedule (FSAOS) were used for data collection. Mean and standard deviation were used to answer the research questions, while analysis of covariance (ANCOVA) was used to test the hypotheses at the 0.05 level of significance. The findings revealed that students taught using PjBL achieved higher mean scores in academic achievement and skill acquisition than those taught using the lecture method. The ANCOVA results showed significant differences in academic achievement ($F = 14.815, p = .001, \eta^2 = .338$) and skill acquisition ($F = 398.641, p = .001, \eta^2 = .932$) in the PjBL group. The study concluded that PjBL is more effective than the lecture method in improving students' learning outcomes in foundry (sand casting).

Keywords: Project-Based Learning, Academic Achievement, Skill Acquisition, Foundry and Forging, Colleges of Education.

Introduction

Technical and Vocational Education and Training (TVET) is a key sector for equipping learners with practical competencies that align with labor market demands and national development goals. Global organizations such as the World Bank (2023) and the International Labor Organization (2023) stress that effective TVET systems improve employability, productivity, and school-to-work transition. Similarly, Chukwu, Adegbite and Yusuf (2024) noted that TVET significantly contributes to workforce preparation, productivity, income generation, and social equity. In Nigeria, TVET is integrated into the education system through the National Policy on Education, which aims to train the workforce in applied sciences, technology, and commerce (FRN, 2013). Therefore, colleges of education, polytechnics, and universities offer therefore offer Metalwork, Electrical/Electronic, Building, and Automobile Technology programs to develop industry-relevant technical skills. Minimum standards, curriculum supervision, and quality assurance are



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maintained, through the National Commission for Colleges of Education (NCCE), especially within the Nigeria Certificate in Education (NCE) programs (NCCE, 2020). Colleges of Education (Technical) combine classroom instruction, workshop practice, and industrial experiences to produce competent and self-reliant graduates capable of contributing to national technological and economic development. Effective TVET delivery depends on modern facilities, qualified instructors, and learner-centered approaches such as project-based learning (Oviawe, Uwameiye & Uddin, 2020), in addition the inclusion of different trade areas helps prepare graduates for vocational teaching and workshop management (Paiko & Abdulrahman, 2023), particularly in metalwork technology.

Metalwork technology is a specialized area of TVET that focuses on metal fabrication, processing, and production through foundry, forging, welding, machining, and fabrication techniques (National Center for Chemical Engineers, 2020). The program combines theory with practical workshop activities to develop students' technical competence, creativity, and problem-solving abilities, while also preparing prospective teachers for effective instructional delivery (Ogbuanya & Efuwape, 2019). Foundry involves producing castings by melting and pouring metal into molds, including processes such as sand casting, which remains widely used because of its versatility and low cost (Alabi & Mohammed, 2020; McClements, 2023; Khurmi & Gupta, 2023). Forging, on the other hand, involves shaping heated metal through compressive forces such as hammering or pressing (Afolabi, Oke, & Alabi, 2024). These processes help students develop competencies in heat application, tool handling, material properties, and workplace safety (Adeniyi, 2023). However, students' achievement in foundry and forging in technical colleges remains low due to inadequate facilities, obsolete equipment, poor funding, limited industrial exposure, and shortage of qualified instructors (Odesanmi & Nuhu, 2024; Olatoye & Adebisi, 2021; Okolie, Igboanugo & Nwajiaba, 2022). Traditional lecture methods further limit the practical mastery and creativity of students making learner-centered strategies such as Project-Based Learning (PjBL) necessary. PjBL engages students in solving real-world problems through active participation, collaboration, and project execution, thereby improving motivation, critical thinking, skill acquisition, retention, and academic achievement (Adams & Nsiah-Gyabaah, 2021; Vygotsky, 1978). Research also indicates that PjBL enhances engagement, collaboration, and problem-solving skills in technical and vocational education (Lavado-Anguera, López-Serrano, & Cañabate, 2024; Goshu & Ridwan, 2024), thereby improving academic achievement. Academic achievement in Foundry and Forging within metalwork technology education reflects students' ability to combine theoretical knowledge with practical competencies in casting, molding, melting, and forging processes. It serves as an important indicator of learning outcomes and students' readiness for industrial practice and technical training. Okwelle and Okeke (2019) explained that academic achievement in technical education measures not only knowledge acquisition but also the practical skill's effective application in industrial contexts. Despite its importance, the achievement of students in Foundry and Forging has remained low. Ogundu and Wordu (2014) attributed poor achievement to inadequate equipment and conventional teaching methods. Similarly, Adamu, Hassan, Muhammad, and Ali (2024) reported that only 41% of NCE metalwork students in NW Nigeria passed Foundry examinations between 2016/2017 and 2018/2019, while 59% failed. These findings highlight the persistent low performance in Foundry and Forging and the need for innovative instructional approaches to improve academic achievement and skill acquisition.

Skill acquisition in Foundry and Forging is essential for developing competencies in pattern making, molding, core making, melting, casting, and forging, enabling students to apply theoretical knowledge to practical industrial tasks. However, studies show that students often demonstrate low practical competence due to inadequate facilities, obsolete equipment, and reliance on teacher-centered instructional methods (Igharo & Obed, 2024; Pindiga 2025 identified serious deficiencies in students' practical competencies in foundry operations, while Igharo and Obed (2024) reported that limits students' hands-on experiences are limited by non-functional workshop equipment. These challenges suggest that many students graduate without adequate mastery of critical foundry and forging skills, emphasizing the need for learner-centered teaching strategies that can improve academic achievement and skill acquisition. Therefore, this study investigates the effects of project-based learning on academic achievement and skill-acquisition in foundry and forging among students in the Colleges of Education in Northwest Nigeria.



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Statement of the problem

Students' academic achievement in Foundry and Forging in Metalwork Technology has remained consistently low among NCE students in Colleges of Education (Technical) in Northwest Nigeria. Examination records from colleges of education (technical) in the study area have shown persistently low academic achievement of students in the foundry and forging courses over the years. This persistent low achievement is a major concern because foundry and forging are the core practical components of Metalwork technology required for the development of technical competencies and mastery of practical skills among student teachers. Despite the importance of foundry and forging for industrial and technological development, students continue to perform below expectations in the Foundry and Forging examinations. Persistently low academic achievement may limit students' ability to acquire the practical competencies required for effective teaching and industrial productivity after graduation. Available records have shown a persistent decline in achievement of students in the course. Evidence from the examination offices of the colleges of education (Technical) in the foundry and forging areas revealed the results in Table 1.

Table 1 Result of the Colleges of Education Metalwork Technology Students' Academic Achievement in Foundry and Forging from 2020 – 2024 academic sessions.

Academic session	No of students who sat	No of students pass	failed students	% pass	% failed
2019/2020	157	67	90	43%	57%
2020/2021	136	60	76	44%	56%
2021/2022	94	52	42	55%	45%
2022/2023	124	53	71	43%	57%
2023/2024	77	33	44	43%	57%
Total	588	265	323	46%	54%

Source: Examination offices of the Colleges of Education (Technical), North-West Nigeria, 2024.

Table 1 highlights a declining trend in academic achievement in Foundry and Forging, which has been partly attributed to inadequate teaching methods that fail to equip students with both cognitive knowledge and practical skills in metalwork technology (Igrubia, Shetima & Paul, 2021; Eze & Osuyi, 2020; Osuyi & Abusomwan, 2021). This situation underscores the need for instructional approaches that enhance skill acquisition, motivation, and retention, as low student motivation has been identified as a key factor influencing academic performance (Mahmud, 2023). Innovative strategies such as Project-Based Learning (PjBL) have been recommended to address these challenges as they engage students in hands-on, real-world projects, improve problem-solving abilities, enhance skill mastery, and foster long-term knowledge retention (Ahmed & Bello, 2022). Despite its potential, there is limited empirical evidence on the effectiveness of PjBL in Foundry and Forging in Metalwork Technology Education in Northwest Nigeria, prompting this study to examine its effects on students' academic achievement and skill acquisition.

Research Questions

The following research questions were answered:

1. What is the mean difference in the academic achievement scores of students taught Foundry (sand casting) using Project-Based Learning and those taught using lecture methods among colleges of education, in North-West Nigeria?
2. What is the mean difference in skill acquisition scores of students taught Foundry (sand casting) using Project-Based Learning and those taught using lecture methods among the colleges of education, North-West Nigeria?

Null Hypotheses

The following hypotheses were tested at the 0.05 level of significance:

- H01.** There was no significant difference in the mean academic achievement scores of the foundry (sand casting) taught by students using Project-Based Learning and those taught using the lecture method among colleges of education in North-West Nigeria.
- H02.** There was no significant difference in the mean skill acquisition scores of the Foundry (sand casting) using Project-Based Learning and those taught using the lecture method among colleges of education in North-West Nigeria.



Literature Review

Project-based learning (PjBL) is a learner-centered instructional strategy that promotes active student participation through practical projects, collaborative learning, problem-solving activities, and real-life task engagement, thereby enhancing meaningful understanding and practical competence among learners. Empirical studies have shown that PjBL and other learner-centered instructional approaches significantly improve academic achievement and skill acquisition in technical and vocational education due to increased participation, hands-on experiences, and active involvement in workshop activities (Adams & Nsiah-Gyabaah, 2021; Ahmed & Bello, 2022; Goshu & Ridwan, 2024). Studies also revealed that practical engagement and project-oriented instruction strengthen students' understanding of technical concepts and improve long-term retention and psychomotor performance in metalwork technology (Ogbuanya & Efuwape, 2019; Oviawe, Uwameiye, & Uddin, 2020). Project-based instructional approaches enhance creativity, critical thinking, teamwork, and problem-solving abilities among technical education students, particularly in practical trades such as foundry and forging (Lavado-Anguera, López-Serrano, & Cañabate, 2024; Adeniyi, 2023). However, despite the growing evidence supporting PjBL in technical and vocational education, studies focusing specifically on its effects on students' academic achievement and skill acquisition in Foundry and Forging among colleges students in North-West Nigeria remain limited.

Theoretical Framework

This study is anchored on Vygotsky's Social Constructivist Theory and Walberg's Theory of Educational Productivity, which collectively explain how PjBL enhances students' academic achievement and skill acquisition through collaboration, active participation, and instructional effectiveness. Vygotsky's Social Constructivist Theory (1978) Social Constructivist Theory explains learning as a social process in which knowledge is constructed through interaction, collaboration, and guided participation. In PjBL students work collaboratively on practical foundry and forging tasks, share ideas, solve problems, and learn from peers and instructors, thereby improving understanding, critical thinking, and practical competence in metalwork technology (Vygotsky, 1978; Oviawe, Uwameiye, & Uddin, 2020). Walberg's Theory of Educational Productivity (1981) emphasizes that instructional quality, motivation, and learning environment. Influence learning outcomes. In PjBL, students engage in practical projects, collaborative activities, and real-world problem-solving tasks that improve instructional effectiveness, learner motivation, and practical performance. The theory further explains that meaningful learning occurs when students are actively involved in the learning process using appropriate instructional strategies and supportive learning environments. Together, these theories provide a strong foundation for the study by explaining how Project-Based Learning improves students' academic achievement and skill acquisition in Foundry and Forging among college students in NW Nigeria.

Research Methodology

This study adopted a non-equivalent, non-randomized, quasi-experimental design with pre- test and post- tests. The independent variable, Project-Based Learning, was manipulated to determine its effect on students' academic achievement and skill acquisition in Foundry and Forging. A pretest was administered to both the experimental and control groups to determine the equivalence of the groups in terms of prior knowledge and ability before the treatment. After the treatment, a post-test was administered to both groups to determine the effectiveness of the treatment and to measure academic achievement and skill acquisition of the students in foundry and forging. The data obtained from both the experimental and control groups were analyzed using descriptive and inferential statistics respectively. The descriptive statistics of mean and standard deviation were used to answer the research questions. Inferential statistics, specifically analysis of covariance (ANCOVA), were used to test the hypotheses the 0.05 level of significance using Statistical Package for Social Sciences (SPSS) version 21.

Presentation of the Results

Research Question 1: What is the mean difference in the academic achievement scores of students taught Foundry (sand casting) using Project-Based Learning and those taught using lecture methods among the colleges of Education in North-West Nigeria?



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Table 5: Pre and Post-test Mean Scores of Academic Achievement of Foundry (sand casting) Metalwork Students Taught Using Project Based Learning and Those Taught Using Lecture

The result presented in Table 5 shows that the experimental group that were taught Foundry (sand casting) using PjBL had

Groups	Post-test					
	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean Gain
Experimental Group	16	9.81	3.06	19.31	3.17	9.5
Control Group	16	10.56	2.45	15.06	1.76	4.5
Mean Difference		0.75		4.25		5.0

a mean score of 9.81 and SD of 3.06 in the pretest and a mean score of 19.31 and SD of 3.17 in the post-test making a pre and post-test mean gain in this experimental group to be 9.5. The control group that was taught using lecture method had a mean score of 10.56 and SD of 2.45 in the pre-test and a mean score of 15.06 and SD of 1.76 in the post-test making pre-test and the post-test mean gain was 4.5. The mean gain difference of 5.0 was in favored of the experimental group taught using PjBL. These results indicate that both project-based learning and lecture the methods are effective in enhancing the academic achievement of sand-casting students. However, the results indicated that the effect of PjBL on the academic achievement of metalwork in sand casting is higher than that of the lecture method. Therefore, PjBL is more effective than the lecture method.

Hypothesis 1: There is no significant difference in the mean academic achievement scores of Foundry (sand casting) taught by students using Project-Based Learning and those taught using the lecture method among colleges of education in North-West Nigeria.

Table 6: Analysis of Covariance (ANCOVA) of the Test of Significance Difference of Student Academic Achievement of Students Taught Foundry (sand casting) metalwork Using Project Based Learning and Those Taught Using Lecture Method

Source	Type III sum of squares	Df	Mean Square	F	Sig.	Partial eta squared
Corrected Model	136.087 ^a	2	68.043	10.924	.000	.430
Intercept	864.990	1	864.990	138.872	.000	.827
PRETEST	27.305	1	27.305	4.384	.045	.131
GROUP	92.278	1	92.278	14.815	.001	.338
Error	180.632	29	6.229			
Total	9463.000	32				
Corrected Total	316.719	31				

a. R Squared = .430 (adjusted R Squared = .390)

The result presented in the Table 6 show that the pretest value had a type III sum of square of 27.305 at df of 1 with an F-calculated value of 4.384 and a significance value of .045, which is less than 0.05. This implies that the pretest had a significant influence on the students post-test scores and was therefore controlled using ANCOVA. The result further shows that the type III sum of square for group is 92.278 at df of 1, F-calculated value is 14.815 with a significance of F at .001 which is less than 0.05. The results revealed that a significant difference between the effects of treatments (project-based learning and lecture method) on the academic achievement of metalwork students in the Foundry (sand casting). Therefore the null hypothesis is rejected at the 0.05 level of significance. Therefore, there is a significant difference in the mean academic achievement scores of metalwork students taught Foundry (sand casting) using PjBL and those taught using lecture methods in favor of the PjBL group.

Research Question 2: What is the Skill-Acquisition scores of students taught Foundry (sand casting) using Project-Based Learning and those taught using lecture methods among the colleges of education in North-West Nigeria?

Groups	Pre-test			Post-test		Mean Gain
	N	$\bar{X}$	SD	$\bar{X}$	SD	
Experimental Group	16	14.13	1.26	32.19	2.56	18.06
Control Group	16	14.06	1.24	24.13	2.22	10.07
Mean Difference		0.07		8.06		7.99



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Table 7: Mean Scores for skill acquisition of students taught Foundry (sand casting) using Project-Based Learning and those taught using lecture method methods

The result presented in Table 7 show that the experimental group taught foundry (sand casting) using PjBL had a mean score of 14.13 with a standard deviation of 1.26 and a post-test mean score of 32.19 with a standard deviation of 2.56, resulting in a mean gain of 18.06. The control group taught using the lecture method had a pre-test mean score of 14.06 with a standard deviation of 1.24 and a mean score of 24.13 with a standard deviation of 2.22, resulting in a mean gain of 10.07. The mean difference between the post-test scores of the two groups was 8.06 in favor of the experimental group. This implies that students in the Foundry (sand casting) classes taught using PjBL acquired more practical skills than those taught using the lecture method among the colleges of education in NW Nigeria.

Hypothesis 2: There is no significant difference in the mean skill-acquisition scores of the Foundry (sand casting) taught by students using PjBL and those taught using the lecture method among the colleges of education in North-West Nigeria.

Table 8: Analysis of Covariance (ANCOVA) of the Test of Significance Difference of Students' Skill-Acquisition of Metalwork Students Taught Foundry (sand casting) Using Project-Based Learning and Those Taught Using Lecture Method

Source	Type III sum of squares	Df	Mean Square	F	Sig.	Partial eta squared
Corrected Model	655.405a	2	327.702	258.145	.001	.947
Intercept	4.033	1	4.033	3.177	.085	.099
SKILL_PRE	135.373	1	135.373	106.640	.001	.786
GROUP	506.054	1	506.054	398.641	.001	.932
Error	36.814	29	1.269			
Total	26061.000	32				
Corrected Total	692.219	31				

The results presented in Table 8 show that the pre-test value had a Type III sum of squares of 135.373 at a degree of freedom of 1 with an F-calculated value of 106.640 and significance value of .001, which is less than 0.05. This implies that the pre-test significantly influenced the post-test skill acquisition scores of the students and was therefore controlled using AoC. The result further revealed that the Type III sum of squares for the group was 506.054 at a degree of freedom of 1 with a F-calculated value of 398.641 and a significance value of .001, which is less than 0.05. The results indicate that there was a significant difference between the effects of PjBL and lecture method on students' skill acquisition in Foundry (sand casting) among colleges of education in NW Nigeria. Therefore, the null hypothesis was rejected at the 0.05 level of significance. This implies that students who were taught Foundry (sand casting) using Project-Based Learning acquired significantly more practical skills than those taught using lecture method.

Discussion of the Findings

The findings of Research Question 1 revealed that students taught Foundry (sand casting) using PjBL demonstrated higher academic achievement compared to those taught using the conventional lecture method. This indicates that PjBL provides learners with opportunities to improve their understanding of concepts through active participation and problem-solving activities. This finding is consistent with previous studies that reported that PjBL enhances students' academic achievement in technical and vocational subjects.

Hypothesis 1 further a revealed that there is a significant difference in the mean academic achievement scores of students taught Foundry (sand casting) using PjBL and those taught using the lecture method, in favor of the PjBL group. This indicates that learner-centered and activity-based instruction enhances the understanding of Foundry students of technical concepts.



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The findings of Research Question 2 showed that students taught Foundry (sand casting) using PjBL acquired higher practical skills than those who were taught using the conventional lecture method. This implies that active participation in project-based tasks enhances practical competence and improves psychomotor performance. Hypothesis 2 further revealed a significant difference in the mean skill acquisition scores of students taught Foundry (sand casting) using PjBL and those taught using the lecture method, in favor of the Project-Based Learning group. Overall, the findings of this study indicate that PjBL is more effective than the lecture method in improving students' academic achievement and skill acquisition in foundry (sand casting).

Conclusions

Based on the findings of this study, the following conclusions were drawn:

1. Students who were taught Foundry (sand casting) using Project-Based Learning demonstrated higher academic achievement than those who were taught using the lecture method.
2. Project-Based Learning significantly enhanced the skill acquisition of students in the Foundry (sand casting) compared to the lecture method.
3. Project-Based Learning was more effective in improving the academic achievement and skill acquisition of Foundry (sand casting) students than the lecture method among students in the Colleges of Education in North-West Nigeria.
4. Overall, PjBL proved to be a more effective instructional strategy for improving students' learning outcomes in Foundry (sand casting) than the lecture method.

Recommendations

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

1. Project-Based Learning should be adopted as a major instructional strategy for teaching Foundry (sand casting) in the colleges of education.
2. Regular training and professional development programs should be organized for metalwork lecturers to equip them with the skills required for the effective implementation of PjBL strategies.
3. Government and college administrators should provide adequate workshop facilities, tools, equipment, and instructional materials necessary for the effective implementation of PjBL in metalwork workshops.
4. The curriculum for technical and vocational education should be reviewed to strengthen the integration of PjBL approaches.
5. Collaborative and interactive learning environments should be encouraged in colleges of education to promote students' active participation, teamwork, and practical competence.

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Correlation Between Attitude and Academic Achievement in Ecology Concepts among Science Secondary School Biology Students in Kano State, Nigeria

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Abstract

This study assessed relationship between attitude and science secondary school students' academic achievement in ecology, Kano State- Nigeria. It was a correlational research design guided by two research objectives, two questions and two null hypotheses. The population comprises of 3110, SSII students out of which a stratified proportionate random sample of 341 students selected by balloting was used for the study. Two instruments: EAT and SAEQ validated by experts for content and face validity were used for data collection. Test-re-test reliability index of EAT was 0.80 while Cronbach's Alpha reliability index for SAEQ was 0.70. Correlation coefficient, PPMCC and Multiple Regression analysis were used for data analysis. Results at $p < 0.05$ indicated an insignificant very weak positive linear relationship between attitude, and student academic achievement in ecology. Result of multiple regression analyses showed that, students attitude could not significantly predict students' academic achievement in ecology. Based on the findings, it can be concluded that, there is insignificant positive relationships between attitude and student academic achievement in ecology. It was recommended that, biology teachers be trained through seminars and inculcating in to students' positive attitude formation for efficient student academic achievement in ecology in Kano State-Nigeria.

Keywords: Attitude, Science Secondary Students academic achievement, Ecology

Introduction

Global risen trends as regards to complex modern biological phenomena specifically, to ecology over the years have continued to pose threat to inter and intra relationship between organisms and their environment academically, biologically and environmentally. This by implication might be connected to the persistence decline and fluctuations in students' attitude and academic achievement in ecology. While the state and the country as a whole are exposed to ecological challenges over decades, there is apparent need of finding solution to our daily encountered ecological problems. Ecology according to the United Nation (UN, 2018), McCallen, *et al.* (2019), Iliyasu (2025) has continued to be a topical societal issue for researchers' and educators and therefore cannot be overemphasized. Research studies have shown that, empirical data on the variables of the present study in question on the science secondary students' level in ecology in Kano State is scanty. Data only generally exist either in the field of humanities, integrated science, physics, biology, mathematics, chemistry, either at kindergarten, junior and senior secondary schools, higher institutions level of learning or particularly on teacher training students. On a contrary, despite the role of attitude in predicting students' academic achievement in ecology, studies of have shown that, students attitude to ecology has not yielded efficient positive result as there is no significant progress in the attitudinal shift towards protecting the environment. (Boiyo, 2015; Kallas *et al.*, 2015). Consequently, students hardly apply their learned ecological concept in solving real life societal and environmental problems for efficient academic achievement in ecology as a whole. Hence, hindering the rational of the inclusion of ecology in the secondary school biology curriculum as maintained by the Nigerian Educational Research and Development NERDC (2009) and National Policy of Education NPE (2014). Attitude in relation to students' academic achievement has been described by different scholars. Dagnew (2017), Ahmad *et al.* (2022) concluded and described attitude as physiological



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mental disposition and neural factor or a state of readiness to respond, organize determining acquired tendency which prepares a person to behave in a certain way towards a specific object or class of objects. This is subject to dynamic influence on behavior as well as the conditions prevailing in the environment. Allport (1935) assertion in his theory of attitudinal change maintained that, attitude is stored in the long memory and characterized by three components of what we know, how we feel and how we behave. Studies by Kpolovie *et al.*(2014), Ogembo *et al.*(2015), Mbajiorgu *et al.*(2017), and Oppong *et al.*(2022) have shown and concluded that, effective and positive students attitude enhances efficient academic achievement among science secondary school students whereas negative attitude among science students lead to inefficient academic achievement in science and specifically in ecology. They further opined that science students see sciences as abstract, irrelevant and difficult and therefore resort to memorization to pass examination. Furthermore, Ogunjinmi *et al.* (2015) , Mbajiorgu *et al.* (2017), Mangal (2018) in another development supported their view and claimed that, attitudinal acquired tendencies are formed from one of the four situations of integration of experience, differentiation of expediencies, trauma or dramatic experiences as well as the adoption of the available attitude in ones environment. They further ascribed the influence of factors of within the individual itself (physical, intellectual, emotional, social and moral development as well as factors within the individuals' environment (his home, and family, social environment outside his family) to attitude the formation and development. Academic achievement describes the level of short or long term educational goal attainment of student that observes and measures aspect of a student's capacity, mastery of skills and subject contents measured with valid and reliable tests in written form (Kpolovie, *et al.*,2014; Steinmayr *et al.*, 2020). In the context of this research , Iliyasu (2025) described academic achievement as the challenging ability of science secondary school student to express, retain, apply or connect what has been learned in ecology in written or practical form, measured by valid examination. Nationally, students' academic achievement as documented by West Africa Examination Council Examination Report (WAEC, 2021) was generally low in Biology. Trends in academic achievements, in biology as shown in documented Science and Technical Schools Board, Kano Statistical Report over 5 years was declining (STSB, 2022). It shows that, out of the total number of Ten thousand and sixteen (10,016) that sat for (WAEC) examination from 2016-2020 only five thousand, two-hundred and thirty six (5236) students earned credit and above in biology Studies have ascribed the decline and fluctuations to factors of science students seeing ecology as abstract, irrelevant and difficult, poor attitude and therefore resort to memorization to pass examination (Ogembo *et al.*, 2015; Mbajiorgu *et al.*, 2017; Oyovwi, 2019; Oppong *et al.*,2022). Ecology is a branch in biology that can literally be referred to as the scientific study of inter and intra relationship between organisms and their environment. The British Ecological Society Organization (2018) and Obormanu *et al.* (2014) technically define ecology as the scientific study of the interaction among and between organisms; the processes influencing the distribution and abundance of the organisms and the transformation of energy flow and matter. Kallasa *et al.* (2015), Ogunjinmi *et al.* (2015) , Feinsinger *et al.* (2021) maintained that, ecology is one of the trends of human ecology and inter discipline that forms an interface with many sciences. Ecology studies the integration between human beings as individuals and/ or social systems and the multidimensional environment from the holistic perspectives. It is geared towards the provision of effective learning and achievement, innovation of knowledge in complimentary perspective. Hence, it is against this background that the problem of this study posed as a question as: Is there any relationship between attitude and science secondary students' academic achievement in ecology in Kano State -Nigeria?

Statement of the Problem

This study assessed the relationship between attitude and science secondary school students' academic achievement in ecology in Kano state -Nigeria. Inefficient attitude along with decline and fluctuations in students' academic achievement in biology, specifically in ecology in Kano State has continued to persist due to scanty empirical data hence hindering effective positive attitude formation towards solving real life ecological problems for efficient academic achievement in ecology.

Objectives of the study

1. Assess the relationship between attitude and academic achievement of students in ecology.
2. Predict the extent of student attitude and student academic achievement in ecology.

Research Questions

1. Can students' attitudes be related with students' academic achievement in ecology?
2. To what extent do students attitude predict student academic achievement in ecology?



Null Hypotheses

The following null hypotheses were formulated at 0.05 level of significant

Ho₁ There is no significant relationship between attitude and academic achievement of Students' in ecology.

Ho₂ There is no significant relationship between the extents of attitude in predicting students Academic achievement in ecology

Research Methodology

The study was a correlational research design comprising a population of three thousand, one hundred and ten (3110) from ten SSII science secondary school students within the three geopolitical zones of Kano North, South and Kano Central. Stratified proportionate random sample of three hundred and forty one (341) students was randomly selected by balloting from each of the respective schools and were used for the study. Two instruments : Ecology Achievement Test (EAT) and SAEQ were used for data collection The instruments consists of two sections, A and B respectively; Section A of EAT and SAEQ consist of Students Personal Data (Age, Class, name of school and Gender) while section B of EAT was 45- minutes, thirty- items WAEC/SSCE past questions, multiple –choice- test, options A-E with difficulty and discrimination Index range values of (0.21-0.67) Sections B of Student Attitude to Ecology Questionnaire (SAEQ) consist of 20 items, five point Likert scale, ordinal, closed ended questionnaire measured by the key below in the order of (a) Strongly Agree =5 (b) Agree=4(c) Uncertain=3 (d) Disagree=2 (e) Strongly disagree= 1. The instruments were validated by five experts in the field of Biology, Education and Science Education from Bayero University, Kano, Ahmadu Bello University, Zaria and Aliko Dangote University of Science and Technology, Wudil for face and content validity. Lawshe's method was used to determine the content validity index and ratio and yielded +1.00 with test - re-test reliability index of 0.81 for EAT and Crombach's alpha reliability index of 0.70 for SAEQ. Correlation Coefficient was used to answer the research question while Pearson Product Moment Correlation Coefficient and regression analysis was use to test the research null hypothesis at a probability of 0.05% level of significance.

Presentation of Results

Research Question 1: Can students' attitudes be related with students' academic achievement in ecology?

Table 1: Summary of Correlation Coefficient Score of the Relationship between Students Attitude (SAEQ) and Students Academic Achievement in Ecology

S/N	Variable	N	Df	R	Remarks
1	Academic Achievement in Ecology	341	339	0.032	Very weak Positive linear relationship
2	SAEQ	341			

Source: Researcher's fieldwork, November, 2023

Result as in Table 1 indicated a very weak positively correlated coefficient value, $r(339) = 0.03$ of the relationship between science secondary school students academic achievement in ecology and students attitude to ecology. To find out if there is very weak positive relationship between the variables it was further subjected to hypothesis testing .The result implied a very weak positive linear relationship between students attitude to ecology and science secondary school students academic achievement in ecology in Kano State- Nigeria. The result further implied that, the relationship of students' attitude to ecology to some degree predisposed their academic achievement in ecology. **HO₁:** There is no significant relationship between attitude and academic achievement of students in ecology.

Table 2: Summary of Pearson Product Moment Correlation Coefficient between Student Attitude to Ecology (SAEQ) and academic achievement of students in ecology.

S/N	Variables	N	r	p-value	Decision
1	Academic Achievement in ecology	341			
2	SAEQ	341	0.032	0.555	Null hypothesis is retained

Correlation is significant at the 0.05 level (2-tailed) $\alpha = 0.05$

Source: Researcher's fieldwork November, 2023

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Result as in Table 2 indicated a value of $r = 0.03$ which shows a very weak positive linear relationship, between student attitude and academic achievement of students in ecology. Result of the correlation was not significant at p , $0.555 > 0.05$; H_0 is retained. It can therefore be inferred that there is no significant relationship between student attitude to ecology and academic achievement in ecology.

Research Question 2 To what extent do students attitude predict student academic achievement in ecology?

Table 3: Summary of Multiple Regression Analyses of the relationship between attitude to ecology (SAEQ) and Students Academic achievement in Ecology

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t stat</i>	<i>p-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Multiple R	.032 ^a					
R Square	.001					
Adjusted R Square	-.002					
Standard Error	3.51					
Observations	341					
Intercept	12.316	2.289	5.382	.000	7.815	16.818
SAEQ	.307	.520	.590	.555	-.715	1.329

Source: Researcher's fieldwork November, 2023

$\alpha = 0.05$;

Result as in Table 3 portrays from the output, the General equation Model of regression equation is $\gamma = 12.316 + .307x$ It shows a multiple correlation coefficient of ($R = 0.032$ and a multiple $R^2 = .001$). This means that, 3.2% of the variance was accounted for by the predictor variable when taken together. Hence answering research question 2: To what extent does students' student attitude predict student academic achievement in ecology? The joint contribution was tested at p -values < 0.05 was insignificant.

Hypothesis Two:

H₀₂ Students' attitude does not significantly predict students' academic achievement in ecology.

The result as in Table 3 further portrays the Summary of Regression Analyses of attitude and students' academic achievement in ecology. The p -value for the test of the regression coefficients of Attitude, p -value = .555 because the p -values $> 0.05 = \alpha$, we accept the null hypothesis in favour of the alternative hypothesis. At the 5% significance level, there is insufficient evidence to suggest that, there is a relationship between the dependent variables "Students academic achievement in ecology and the independent variable and attitude.

Discussion of the findings

Result of the relationship between students' attitude and academic achievement in ecology as in Table 1 and 2 yielded very weak positive and not significant linear relationships. In line with the findings, very weak positive, linear relationship between students' attitude and academic achievement in ecology implies that, effective students' academic achievement in ecology might facilitate students efficient students positive attitude to ecology. This might be ascribed to student low level of awareness on what they know, how they feel and how they behave to series of outcries emanating from the ecological consequences as well as imbalance of the inter and intra relationship between organisms and their environment. However, this according to the Economic Co-operation and Development OECD. (2018) emphasized the need to call for a dynamic shift of the needs and aspirations of the society. Efficient attitude of students might enhance the creation of new opportunities and solution that can enrich our lives towards promoting an inclusive and sustainable future of the environment and socioeconomic development of the nation as a whole. Studies have shown that efficient attitude to ecology as well as solving ecological related problem of the society might enhance efficient academic achievement. Ogembo *et al.* (2015), Oyovwi (2019) in their studies reported and concluded that, positive attitude of science students increases students academic achievement whereas negative attitude among science students lead to poor academic achievement in science, biology and ecology respectively.

On the other hand, ineffective students' attitude to ecology might hinder a significant progress in the attitudinal move of a more protective environment among students. This by implication contradicts the report of Kallas *et al.* (2015) as the burden of series of outcry as regards to ecological problems and consequences may continue to rise and pose threat and



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disequilibrium to the scientific inter and intra relationship between organisms and their environment. Inefficient students' attitude might equally hamper the formation and development of positive attitude as well as lack of improvement of academic achievement towards modern biological phenomena, specifically ecology and environment among secondary school students as enshrined in the secondary school modern biology curriculum. The findings of the researcher was in line in with the findings of previous studies of Boiyo *et al.* (2015) in Kibera and Kasarani Division in Nairobi, Kenya, on environmental attitude and ecological behavior, Astalini *et al.* (2019) in Jambi Province, Indonesia on student attitude towards science. Oppong *et al.* (2022) in Ghana on college students attitude towards science and Adejimi *et al.* (2022) in Ibadan, Oyo state, Nigeria on secondary school students in biology respectively. On a contrary, on the bases of significance, the findings differs with the findings of Langat (2015) in Kiambu County, Kenya on mathematics, Omotade *et al.* (2016) in Ado, Ekiti State Nigeria, Dagneu (2017) in Gondar, Ethiopia, and Ahmad *et al.* (2022) in Islamabad, Pakistan who reported a significant relationship between secondary school students' attitude in biology. Moreover, result as in Table 3 portrays multiple regressions as there is insufficient evidence to suggest that, there is significant relationship between the dependent variables "Students academic achievement in ecology and the independent variable "attitude. This might be ascribed to inefficient attitude as regards to inefficient students' academic achievement in ecology. The findings was in a contrary with the findings Andamon and Tan (2018) that reported that Students' attitude as best predictors of student performance in mathematics, Kpolovie *et al.* (2014) in Bayelsa, Nigeria reported a positive correlation of attitude to school with students academic achievement and Dagneu (2017) in Gondar, Ethiopia on student attitude and achievement motivation as predictors of student academic achievement.

Conclusion

Based on the findings, it can be concluded that, relationship between attitude and students' academic achievement in ecology was linearly very weak positive and insignificant. More so, attitude did not predict science secondary school students' academic achievement in ecology in Kano-Nigeria.

Recommendations

1. Biology teachers should inculcate in to student the development of positive attitude by emphasizing on real world ecological related examples during ecology class for efficient students academic achievement in ecology.
2. Student should imbibe efficient positive attitude in solving real life ecological problems.
3. Government should encourage the introduction of school clubs and societies. For example, Conservation Biology Association

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Evaluating Teachers' Perceived Opportunities and Challenges on Integrating Artificial Intelligence among Public Secondary Schools in Delta State, Nigeria

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Abstract

This study investigated teachers' perceived opportunities and challenges of artificial intelligence integration in urban and rural public secondary schools in Delta State, Nigeria. Two research questions and two null hypotheses guided the study, which was anchored on two theories. A descriptive-comparative survey design was adopted. The population comprised 11,011 teachers in 488 public secondary schools across 25 local government areas. Using the Taro Yamane formula and multistage sampling, 386 teachers were selected, while 380 questionnaires were analyzed. Data were collected using the validated 20-item Artificial Intelligence Integration Opportunities and Challenges Questionnaire. Mean and standard deviation answered the research questions, while independent-samples t-tests tested the hypotheses at the .05 significance level. The findings showed that teachers recognized AI opportunities for lesson preparation, personalized instruction, feedback, assessment and independent learning. They identified unreliable electricity, poor internet connectivity, inadequate devices, limited competence, insufficient training and ethical concerns as challenges. Urban teachers perceived the opportunities more strongly, whereas rural teachers perceived the challenges more strongly. The study concluded that AI offered educational value, but unequal infrastructure and support limited its equitable integration. It recommended improved electricity, connectivity and digital devices, particularly in rural schools, alongside practical teacher training, technical support and responsible-use guidelines.

Keywords: Artificial intelligence integration, Teachers' perceptions, Opportunities, Challenges, public secondary schools.

Introduction

Artificial intelligence has become increasingly relevant to education because of its ability to support activities that ordinarily require human reasoning, decision-making and problem-solving. In educational settings, AI includes intelligent tutoring systems, learning analytics, chatbots, automated assessment, virtual laboratories and content-generating applications. These technologies can support teaching, learning and educational decision-making by processing information and responding to learners' needs (Hwang et al., 2020). Ouyang and Jiao (2021) explained that AI in education may be AI-directed, AI-supported or AI-empowered. These approaches allow technology to guide learning, assist learners or provide resources that enable learners to take greater control of their educational experiences. Through these functions, AI can personalize instruction, provide immediate feedback, generate learning materials and help teachers identify students' areas of difficulty. At the secondary-school level, AI can assist teachers in preparing lessons, developing assessment questions, simplifying difficult concepts and accommodating differences in students' learning abilities. It can also provide students with opportunities for independent practice and continuous feedback. Nevertheless, the educational value of AI depends on how effectively it is connected to appropriate learning objectives and sound instructional practices (Luckin & Cukurova, 2019). Okunade (2024) identified adaptive learning systems, intelligent tutoring systems and virtual laboratories as valuable AI applications for science teaching in Nigerian secondary schools. Such applications may be particularly useful where physical laboratory materials are inadequate or certain scientific processes are difficult to demonstrate. AI can also assist teachers in producing examples, illustrations and simulations suited to the curriculum. Despite these opportunities, effective AI integration requires reliable electricity, internet connectivity, digital devices, technical support and competent teachers. Public secondary schools may differ considerably in their access to these resources. Teachers must also be able to evaluate AI-generated content, protect students' personal information and prevent inappropriate dependence on automated answers. Other concerns include algorithmic bias, academic dishonesty, inaccurate information and the possible weakening of students' critical-thinking abilities (Holmes et al., 2022). Miao et al. (2021)



Evaluating Teachers' Perceived Opportunities and Challenges on Integrating ... Moses, P. Z. O. & Moses-Promise, O. J. (2026) maintained that AI adoption in education should be guided by inclusion, equity, transparency and human-centred decision-making. Teachers should therefore remain responsible for determining the suitability of AI-generated materials and guiding students towards ethical use. Without adequate training and institutional support, the availability of AI applications may not result in meaningful classroom integration. A review by Zhai et al. (2021) revealed growing scholarly interest in AI applications in education, but much of the evidence originated outside the immediate context of Nigerian public secondary schools. Consequently, information remains limited regarding the opportunities teachers in Delta State believe AI offers, the challenges they perceive and whether these perceptions differ between urban and rural schools. This study therefore investigated teachers' perceived opportunities and challenges of artificial intelligence integration in public secondary schools in Delta State, Nigeria.

Statement of the Problem

Artificial intelligence offers considerable possibilities for improving teaching, learning, assessment and educational decision-making through personalized learning, automated feedback, intelligent tutoring systems, virtual laboratories and content-generation tools. Nevertheless, the effective integration of these technologies in public secondary schools cannot be assumed. Teachers must possess the competence to select appropriate AI applications, evaluate generated information and guide students towards responsible use. At the same time, unreliable electricity, limited internet connectivity, inadequate digital devices, insufficient training, high costs, weak technical support and unclear policy direction may constrain implementation. Ethical concerns involving inaccurate information, algorithmic bias, students' privacy, academic dishonesty and excessive dependence on automated responses further complicate classroom use. Differences in the facilities and support available to urban and rural schools may also influence how teachers perceive both the benefits and difficulties associated with AI integration. Despite increasing attention to AI in education, insufficient context-specific evidence exists regarding the opportunities and challenges perceived by teachers in public secondary schools in Delta State. Much of the existing literature is conceptual, concentrated on higher education, conducted outside Nigeria or focused on teachers' readiness to teach AI as a subject. Consequently, it remains unclear what instructional opportunities teachers in Delta State believe AI provides, which challenges are most likely to hinder its effective integration and whether the perceptions of teachers in urban and rural schools differ significantly. Without such evidence, AI-related policies, training programmes and infrastructure investments may fail to address the actual needs of teachers and schools. This study was therefore undertaken to investigate teachers' perceived opportunities and challenges of artificial intelligence integration and compare the perceptions of teachers in urban and rural public secondary schools in Delta State.

Purpose of the Study

The main purpose of the study is to investigate teachers' perceived opportunities and challenges of artificial intelligence integration in public secondary schools in Delta State, Nigeria. Specifically, the study sought to:

1. determine the opportunities teachers perceived that artificial intelligence offered for teaching and learning and compared the mean ratings of teachers in urban and rural public secondary schools; and
2. ascertain the challenges teachers perceived as constraining artificial intelligence integration and compared the mean ratings of teachers in urban and rural public secondary schools.

Research Questions

The following research questions guided the study:

1. What opportunities did teachers in urban and rural public secondary schools perceive that artificial intelligence offered for teaching and learning in Delta State?
2. What challenges did teachers in urban and rural public secondary schools perceive as constraining the effective integration of artificial intelligence?

Hypotheses

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

- H₀₁: There is no significant difference between the mean ratings of teachers in urban and rural public secondary schools regarding the perceived opportunities of artificial intelligence integration.
- H₀₂: There is no significant difference between the mean ratings of teachers in urban and rural public secondary schools regarding the perceived challenges of artificial intelligence integration.



Significance of the Study

The study provided evidence on the opportunities and challenges associated with artificial intelligence integration in public secondary schools in Delta State. Its findings assisted educational policymakers and school administrators in identifying areas requiring improved infrastructure, teacher training, technical support and ethical guidelines. Teachers gained a clearer understanding of how AI could support lesson preparation, classroom instruction and assessment, while students benefited from recommendations aimed at promoting responsible and effective AI use. The study also contributed to the existing literature and provided useful information for researchers conducting related studies on AI integration in secondary education.

Review of Related Literature

Conceptual Review

Artificial intelligence in education referred to the use of computer systems capable of learning, reasoning, generating content and making data-based decisions to support teaching, learning and assessment. Its applications include intelligent tutoring systems, adaptive learning platforms, chatbots, automated assessment, learning analytics and virtual laboratories. AI has developed from earlier programmed instructional technologies into more responsive systems that can analyze learner's performance and adjust educational support accordingly (Williamson & Eynon, 2020). Depending on its application, it may function as a tutor, teaching assistant, analytical tool or learning partner (Xu & Ouyang, 2022). AI integration differs from teaching AI as a subject. Integration concerns using AI to improve educational activities, whereas AI education develops learners' understanding of how AI systems function and should be used. Both require AI literacy, including the ability to understand, apply and critically evaluate AI-generated information (Ng et al., 2021). Although AI can promote personalized and inclusive education, it should complement rather than replace teachers' professional and interpersonal roles (Pedro et al., 2019; Selwyn, 2019). AI creates opportunities for personalized learning by tailoring content, tasks and feedback to learners' skills and pacing. It can pinpoint areas of struggle, suggest appropriate activities and offer immediate support. AI-enabled pedagogies may also bolster inquiry, problem-solving and independent learning (Yue et al., 2022). Teachers can apply AI to develop lesson resources, produce assessment items, manage performance records and detect common learning challenges. Meylani (2024) emphasized the need to prepare educators to integrate these tools into their professional practice. However, realizing these benefits depends on appropriate curriculum planning (Chiu & Chai, 2020). AI integration can also develop students' motivation, creativity, data literacy and responsible technology use. Students' willingness to learn about AI is influenced by their attitudes, confidence and perceived control (Chai et al., 2022). Through guided activities, learners can analyze information, collaborate and develop solutions to practical problems. Such experiences may promote transversal skills and understanding of data practices required in an AI-driven society (Okada et al., 2025; Olari & Romeike, 2025). Effective AI integration depends on electricity, internet connectivity, digital devices and technical support. Inadequate electricity supply can interrupt technology-supported teaching and restrict access to online platforms (Akinola, 2022). Differences in infrastructure and digital competence may also create inequalities between urban and rural schools, reflecting a wider digital divide in access and meaningful technology use (van Dijk, 2020). Economic difficulties can further limit schools' capacity to acquire and maintain AI-related resources (Bou Zeid & Abouchédid, 2026). Teacher skills and self-assurance create additional obstacles. Educators must be able to choose suitable AI tools, craft effective prompts, assess generated content, and align AI applications with curriculum goals. Digital and AI literacy frameworks show that responsible adoption demands technical, pedagogical, and ethical competencies (Tomczyk, 2024). Insecure teachers may avoid using AI or apply it poorly, since readiness and technology acceptance are shaped by self-efficacy, perceived usefulness, and perceived ease of use (Rajapakse et al., 2024; Scherer et al., 2019). AI may generate inaccurate information, reproduce bias and expose students' personal data. It may also encourage academic dishonesty or dependence on automated answers. Holmes et al. (2022) therefore recommended an ethical framework involving teachers, learners, parents, policymakers and technology developers. Clear school policies are needed to guide data protection, assessment practices and acceptable classroom use. AI integration should ultimately preserve inclusion, transparency, human agency and teachers' professional judgment (UNESCO, 2021).

Theoretical Framework

The study was anchored on the Technology Acceptance Model and the Diffusion of Innovations Theory. The Technology Acceptance Model was developed by Davis (1989) to explain why individuals accept or reject a technological system. The



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model identifies perceived usefulness and perceived ease of use as the principal factors influencing attitude, behavioural intention and actual technology use. Perceived usefulness concerns the extent to which a person believes that a technology improves performance, while perceived ease of use refers to the belief that using it requires little difficulty or effort. Applied to education, teachers are more likely to accept AI when they believe that it improves lesson preparation, classroom instruction, assessment and students' learning. These benefits represent the perceived opportunities examined in the study. Conversely, inadequate competence, complicated applications, unreliable internet access and concerns about accuracy may reduce perceived ease of use. Scherer et al. (2019) confirmed that perceived usefulness and ease of use are important in explaining teachers' adoption of educational technologies. The model was relevant because teachers' perceptions could influence their willingness to integrate AI into classroom activities. It also helped explain why teachers in urban and rural schools might respond differently when their access to infrastructure, training and technical support differed. Teacher self-efficacy strengthened this explanation because confidence in personal competence affects readiness to use or teach with AI (Rajapakse et al., 2024). Rogers' (2003) Diffusion of Innovations Theory explains how new ideas and technologies spread through a social system over time. According to the theory, adoption is influenced by an innovation's relative advantage, compatibility, complexity, trialability and observability. Relative advantage concerns whether an innovation is regarded as better than existing practices, while compatibility refers to its consistency with users' needs and values. Complexity describes its perceived difficulty, trialability concerns opportunities for limited experimentation, and observability refers to the visibility of its results. AI may be accepted more readily when teachers observe that it saves time, improves feedback and supports students' learning. Adoption may be slower when AI tools are difficult to operate, incompatible with curriculum demands or unsupported by school infrastructure. Differences in electricity, connectivity, digital devices and professional development may therefore affect the diffusion of AI across public secondary schools. The theory supported the comparison of urban and rural teachers because innovations do not spread uniformly where resources and institutional support differ. Siemens (2005) maintained that knowledge may exist across people, information sources and technological systems. This perspective supported AI-assisted learning because students can access, evaluate and connect information from different digital resources. Nevertheless, teachers remain essential in helping learners judge the reliability and relevance of such information. Chiu and Chai (2020) applied this perspective to AI curriculum planning, while Chai et al. (2023) showed that motivation influenced students' intentions to learn AI. The digital divide perspective also explained how unequal access, competence and usage opportunities could shape teachers' experiences of AI (van Dijk, 2020). Together, the Technology Acceptance Model and Diffusion of Innovations Theory provided individual and institutional explanations for AI integration. The former explained teachers' perceptions and acceptance, while the latter accounted for how school conditions influenced the spread of AI-supported practices. These theories were therefore appropriate for examining perceived opportunities, challenges and urban–rural differences in public secondary schools.

Empirical Review of Related Studies

Zawacki-Richter et al. (2019) conducted a global systematic review of artificial intelligence applications in higher education. The study population comprised 2,656 publications identified from EBSCO Education Source, Web of Science, and Scopus between 2007 and 2018, while 146 articles met the inclusion criteria. The researchers used a systematic-review design and developed a coding framework in EPPI-Reviewer for data extraction. Descriptive analysis was performed with R using the tidyR package. The findings classified AI applications into profiling and prediction, assessment and evaluation, adaptive systems and personalization, and intelligent tutoring systems. The review also revealed limited involvement of educators and inadequate attention to ethical and pedagogical issues. However, its higher-education and document-based orientation did not explain teachers' experiences in public secondary schools in Delta State. Using meta-analytic structural equation modelling, Scherer et al. (2019) investigated teachers' acceptance of educational technologies across multiple countries. The review targeted empirical research on technology acceptance among both pre-service and in-service teachers. Its dataset comprised 114 studies, 124 correlation matrices, and 34,357 teachers. The Technology Acceptance Model and its extensions provided an adequate fit to the pooled data. Perceived usefulness and perceived ease of use influenced behavioural intention indirectly via teachers' attitudes, while there were also direct links from perceived usefulness to behavioural intention and from attitude to actual technology use. Although the results highlighted the central role of teachers' perceptions in adopting technology, the technologies examined were not limited to AI. The study likewise did not address opportunities, challenges, or urban–rural differences specific to secondary-school teachers. In Nigeria, Ayanwale et al. (2022) examined in-service teachers' readiness and intention to teach AI. The finite population of Nigerian



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teachers was not stated. A voluntary online survey produced 385 responses, of which 368 responses from teachers at elementary to high-school levels were analyzed. The study adopted a quantitative cross-sectional survey design and measured eight constructs with a structured questionnaire. Variance-based partial least-squares structural equation modelling was used for analysis. Confidence in teaching AI predicted behavioural intention, while the perceived relevance of AI strongly predicted readiness. Conversely, AI anxiety did not predict intention, and the perceived social benefits of AI did not predict readiness. Despite its relevance to Nigeria, the study combined teachers from different educational levels and concentrated on readiness to teach AI as a subject. It did not specifically examine the perceived opportunities and challenges of AI integration among public secondary-school teachers in Delta State. Chai et al. (2023) surveyed 509 secondary students in Shandong, Zhejiang and Shanghai who had completed at least one semester of AI instruction, using a quantitative model-testing design and a questionnaire on AI knowledge, programming efficacy, autonomy, learning resources, AI for social good, and behavioural intention. EFA (SPSS 25), CFA and SEM (AMOS 25) showed that learning resources, autonomy, and perceptions of AI for social good predicted intention to continue AI learning; AI knowledge did not predict social-good perceptions, and programming efficacy negatively affected autonomy. The sample's restriction to students with prior AI instruction limits applicability to teachers' experiences and infrastructural conditions in Delta State. Rajapakse et al. (2024) surveyed over 1,300 Sri Lankan public-school ICT teachers (~20% of the national ICT-teacher pool) via snowball sampling, using a Bandura-based self-efficacy questionnaire analyzed with PLS-SEM. Teachers reported low AI-teaching self-efficacy; emotional/physiological states and imagined teaching experiences had the strongest effects, mastery had a smaller effect, and vicarious experience and verbal persuasion were non-significant. The study's focus on ICT teachers and self-efficacy omitted assessment of perceived educational opportunities and technological, ethical, infrastructural, and professional challenges. A different perspective emerged from the cross-national mixed-methods investigation conducted by Okada et al. (2025) in the United Kingdom, Greece, and Brazil. The broader CONNECT project had engaged more than 1,500 teachers and 50,000 students across five countries, while the analytical sample comprised 330 secondary-school students from the three selected countries. Data were collected longitudinally for one year through student self-assessments, teacher ethnographic accounts, researchers' observations, and AI-enabled project work. Quantitative data were analysed with descriptive statistics and exploratory factor analysis in SPSS 27, while qualitative accounts were examined thematically. Seven dimensions of AI-supported transversal competence emerged, including proactive exploration, problem-solving, scientific citizenship, and authentic learning. Scientific citizenship received the strongest ratings, whereas proactive exploration was comparatively weak. However, this intervention-based study measured students' competency development rather than teachers' perceptions of routine AI integration in Nigerian public schools. Yue et al. (2022) systematically reviewed empirical K–12 AI teaching programmes published in the Web of Science database between 2010 and 2022. The eligible empirical publications constituted the population, while 32 studies formed the final sample. Using a systematic-review design, the researchers coded the selected studies according to research characteristics, pedagogical designs, assessment approaches, and outcomes. Descriptive and thematic analyses showed that direct instruction, collaborative learning, participatory learning, project-based learning, game-based learning, and design-oriented learning were frequently employed. Positive outcomes covered AI knowledge, technical skills, attitudes, and engagement. Nevertheless, many studies had small samples and relied substantially on interviews and self-reports. The review did not provide direct evidence from teachers working under the infrastructural and socioeconomic conditions of Delta State. Zhai et al. (2021) reviewed AI-in-education papers indexed in the Social Sciences Citation Index (Education and Educational Research) from 2010–2020, selecting 100 papers (63 empirical reporting 74 studies, 37 analytical) for content analysis. Their coding clustered the literature into development, application, and integration layers and highlighted trends (deep learning, IoT, swarm intelligence, neuroscience, feedback, adaptive and immersive learning) and problems (misapplied AI, shifting teacher/learner roles, social and ethical concerns). As a global synthesis across educational levels, it did not capture how teachers in Delta State perceive these opportunities or whether views vary by school location. Xu and Ouyang (2022) performed a global systematic review using a complex adaptive-systems framework, sampling 53 peer-reviewed articles across three analytical categories. With a conceptual coding framework and qualitative synthesis, they found AI acting as a new subject, a direct learning mediator, or a supportive assistant, altering instructor–student, student–self and student–student relationships. Because their conclusions are drawn from published studies rather than practising teachers, they do not reveal how infrastructure, competence, ethics, cost, and school location influence AI integration in Delta State. Collectively, the studies demonstrated that AI offered opportunities for



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 personalized instruction, assessment, feedback, problem-solving, learner engagement, and administrative support. They also identified challenges involving teacher competence, self-efficacy, ethical responsibility, resources, and changes in professional roles. Three gaps remained. First, most studies originated outside Nigeria or combined several educational levels. Second, many concentrated on students, ICT teachers, readiness, or behavioural intention rather than teachers' simultaneous perceptions of opportunities and challenges. Third, none directly compared teachers in urban and rural public secondary schools in Delta State. The present study addressed these contextual, population, and variable gaps through a descriptive-comparative survey of public secondary-school teachers in Delta State.

Research Methodology

The study adopted a descriptive-comparative survey research design. This design was appropriate because it enabled the researchers to collect information on teachers' perceived opportunities and challenges of artificial intelligence integration without manipulating any variable. Its comparative component also permitted the comparison of responses obtained. The population comprised of 11,011 teachers serving in 488 public secondary schools across the 25 local government areas of Delta State. These figures were obtained from the staff and school records of the Delta State Post-Primary Education Board dated January 9, 2025. The sample size was determined at a 5% margin of error using Taro Yamane's (1967) simplified sample-size formula for a finite population:

$$n = N / [1 + N(e)^2]$$

Where: n = Required sample size; N = Population size; e = Margin of error

Given: N = 11,011; e = 0.05

Therefore: $n = 11,011 / [1 + 11,011(0.05)^2]$; $n = 11,011 / [1 + 11,011(0.0025)]$; $n = 11,011 / [1 + 27.5275]$; $n = 11,011 / 28.5275$; $n = 385.98$; $n \approx 386$ teachers

A multistage sampling procedure was employed. First, the public secondary schools were stratified according to the three senatorial districts of Delta North, Delta Central, and Delta South. Within each senatorial district, the schools were further classified into urban and rural locations. A proportionate number of schools and teachers was selected from each category, after which simple random sampling was used to select the participating schools and respondents. This procedure ensured adequate representation of teachers across the three senatorial districts and the two school-location categories. Data were collected using a researcher-developed instrument titled the Artificial Intelligence Integration Opportunities and Challenges Questionnaire (AIIOCQ). The instrument consisted of three sections. Section A obtained respondents' demographic information, particularly school location. Section B contained 10 items measuring teachers' perceived opportunities associated with AI integration, while Section C contained 10 items measuring the perceived challenges. The 20 substantive items were rated on a four-point scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The AIIOCQ was subjected to face and content validation by experts in educational technology and measurement and evaluation. The experts examined the clarity, relevance, appropriateness, and coverage of the items in relation to the purposes and research questions. Their observations guided the correction of ambiguous statements and the removal of repetitive items. The instrument was trial-tested among public secondary-school teachers outside the schools selected for the main study. Cronbach's alpha was used to determine the internal consistency of the opportunities and challenges clusters. The reliability coefficients obtained were [insert opportunities coefficient] and [insert challenges coefficient], respectively, while the overall coefficient was [insert overall coefficient]. Only items that met the minimum reliability benchmark of 0.70 were retained. The selected teachers completed the questionnaire with the assistance of trained research assistants. Ethical approval was obtained from the appropriate institutional research ethics committee, while administrative permission was secured from the relevant education authorities and participating schools. Respondents gave informed consent and participated voluntarily. Their anonymity, confidentiality, and right to withdraw were protected, while the collected data were securely stored and reported only in aggregate form. Completed questionnaires were retrieved, checked for completeness, coded, and prepared for analysis. Mean and standard deviation were used to answer the two research questions. A criterion mean of 2.50 was applied in interpreting the responses. An item with a mean score of 2.50 or above was accepted as a perceived opportunity or challenge, whereas an item with a mean score below 2.50 was rejected. Independent-samples t-tests were used to test the two null hypotheses at the 0.05 level of significance. A null hypothesis was rejected when the probability value was equal to or less than 0.05 but retained when the probability value was greater than 0.05.



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Presentation of Results

Of the 386 questionnaires administered, 380 were correctly completed and used for analysis, representing a response rate of 98.4%. The valid respondents comprised 210 teachers from urban public secondary schools and 170 teachers from rural public secondary schools. The results were presented according to the research questions and corresponding null hypotheses.

Research Question 1

What opportunities did teachers in urban and rural public secondary schools perceive that artificial intelligence offered for teaching and learning in Delta State?

Table 1: Mean and Standard Deviation of Urban and Rural Teachers' Ratings of the Perceived Opportunities of Artificial Intelligence Integration in Public Secondary Schools in Delta State

S/N	Perceived opportunities of AI integration	Urban Public Secondary Schools			Rural Public Secondary Schools		
		Mean	SD	Decision	Mean	SD	Decision
1	Personalizes instruction according to students' learning abilities	3.42	0.58	Agree	3.12	0.65	Agree
2	Provides students with immediate feedback	3.37	0.61	Agree	3.05	0.68	Agree
3	Supports lesson preparation and generation of instructional materials	3.46	0.55	Agree	3.18	0.62	Agree
4	Facilitates automated assessment and grading	3.31	0.64	Agree	2.96	0.71	Agree
5	Assists teachers in identifying students' learning difficulties	3.35	0.60	Agree	3.01	0.69	Agree
6	Improves students' engagement in classroom activities	3.28	0.67	Agree	2.91	0.73	Agree
7	Promotes independent and self-paced learning	3.26	0.65	Agree	2.95	0.70	Agree
8	Provides virtual laboratories and simulations for difficult concepts	3.18	0.72	Agree	2.76	0.78	Agree
9	Improves record management and administrative efficiency	3.32	0.63	Agree	2.89	0.75	Agree
10	Strengthens teachers' digital competence and professional development	3.29	0.64	Agree	2.98	0.71	Agree
Grand mean/standard deviation		3.32	0.41	Agree	2.98	0.48	Agree

Table 1 showed that the mean ratings for all 10 items exceeded the criterion mean of 2.50 for both groups. Urban teachers recorded a grand mean of 3.32 and a standard deviation of 0.41, while rural teachers recorded a grand mean of 2.98 and a standard deviation of 0.48. Teachers in both locations therefore agreed that AI offered opportunities for teaching and learning. Urban teachers nevertheless recorded higher ratings across all the items. Lesson preparation and generation of instructional materials received the highest urban mean of 3.46, while virtual laboratories and simulations recorded the lowest rural mean of 2.76.



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Hypothesis 1

There is no significant difference between the mean ratings of teachers in urban and rural public secondary schools regarding the perceived opportunities of artificial intelligence integration.

Table 2: Independent-Samples t-Test of the Difference between Urban and Rural Teachers' Mean Ratings of the Perceived Opportunities of Artificial Intelligence Integration

Variable	Urban Teachers			Rural Teachers			df	t	p	Decision
	N	Mean	SD	N	Mean	SD				
Perceived opportunities	210	3.32	0.41	170	2.98	0.48	378	7.51	< .001	Reject H ₀₁

Table 2 showed a calculated t-value of 7.51 with 378 degrees of freedom and a probability value below .001. Because the probability value was less than the .05 significance level, the first null hypothesis was rejected. A significant difference therefore existed between urban and rural teachers' mean ratings of the perceived opportunities of AI integration. The higher mean recorded by urban teachers indicated that they perceived the opportunities more strongly than rural teachers.

Research Question 2

What challenges did teachers in urban and rural public secondary schools perceive as constraining the effective integration of artificial intelligence?

Table 3: Mean and Standard Deviation of Urban and Rural Teachers' Ratings of the Perceived Challenges of Artificial Intelligence Integration in Public Secondary Schools in Delta State

S/N	Perceived challenges of AI integration	Urban Public Secondary Schools			Rural Public Secondary Schools		
		Mean	SD	Decision	Mean	SD	Decision
1	Unreliable electricity supply limits the use of AI applications	3.16	0.71	Agree	3.55	0.59	Agree
2	Poor internet connectivity restricts access to AI platforms	3.11	0.69	Agree	3.51	0.61	Agree
3	Inadequate digital devices hinder AI integration	3.05	0.73	Agree	3.46	0.62	Agree
4	The cost of acquiring and maintaining AI resources is high	3.02	0.70	Agree	3.37	0.65	Agree
5	Teachers possess insufficient competence to use AI effectively	2.96	0.68	Agree	3.29	0.67	Agree
6	Inadequate training and technical support constrain implementation	2.91	0.72	Agree	3.26	0.66	Agree
7	Data privacy and ethical concerns discourage classroom use	2.82	0.75	Agree	3.16	0.70	Agree
8	AI applications may generate inaccurate or biased information	2.76	0.74	Agree	3.11	0.71	Agree
9	AI may encourage academic dishonesty among students	2.83	0.71	Agree	3.17	0.68	Agree
10	Excessive AI use may create dependence on automated answers	2.78	0.73	Agree	3.22	0.66	Agree



S/N	Perceived challenges of AI integration	Urban Public Secondary Schools			Rural Public Secondary Schools		
		Mean	SD	Decision	Mean	SD	Decision
Grand mean/standard deviation		2.94	0.44	Agree	3.31	0.42	Agree

Table 3 indicated that the mean ratings for all the challenge items exceeded the criterion mean of 2.50. Urban teachers recorded a grand mean of 2.94 and a standard deviation of 0.44, while rural teachers recorded a grand mean of 3.31 and a standard deviation of 0.42. Both groups agreed that the identified factors constrained effective AI integration. Rural teachers recorded higher mean ratings across all 10 items, showing that they perceived the challenges more strongly. Unreliable electricity supply received the highest rural mean of 3.55, followed by poor internet connectivity with a mean of 3.51 and inadequate digital devices with a mean of 3.46.

Hypothesis 2

There is no significant difference between the mean ratings of teachers in urban and rural public secondary schools regarding the perceived challenges of artificial intelligence integration.

Table 4: Independent-Samples t-Test of the Difference Between Urban and Rural Teachers' Mean Ratings of the Perceived Challenges of Artificial Intelligence Integration

Variable	Urban Teachers			Rural Teachers			df	t	p	Decision
	N	Mean	SD	N	Mean	SD				
Perceived challenges	210	2.94	0.44	170	3.31	0.42	378	-8.32	< .001	Reject H ₀₂

Table 4 produced a calculated t-value of -8.32 with 378 degrees of freedom and a probability value below .001. Since the probability value was less than .05, the second null hypothesis was rejected. A significant difference existed between the mean ratings of urban and rural teachers regarding the perceived challenges of AI integration. The higher mean recorded by rural teachers indicated that they perceived greater infrastructural, professional and ethical challenges than teachers in urban public secondary schools.

Discussion of Finding

The first finding revealed that teachers in both urban and rural public secondary schools perceived AI as offering opportunities for teaching and learning. Every opportunity item recorded a mean above the 2.50 criterion for both groups, showing that teachers recognized AI's usefulness for personalizing instruction, providing immediate feedback, preparing materials, conducting assessments, identifying learning difficulties and supporting independent learning. This finding agreed with Hwang et al. (2020), who identified feedback, assessment and personalization as major applications of AI in education. It also supported Xu and Ouyang's (2022) view of AI as a tutor, teaching assistant and supportive learning tool. Lesson preparation and the generation of instructional materials received the highest ratings, with means of 3.46 for urban teachers and 3.18 for rural teachers. Teachers therefore appeared to value AI most for reducing the time and effort required to develop lesson content, examples and assessment materials, consistent with Meylani (2024). Virtual laboratories and simulations received the lowest ratings, although their means remained acceptable. Their lower position may reflect the specialized devices, connectivity and competence required to use them, despite their value for explaining difficult scientific concepts (Okunade, 2024). The first hypothesis showed a significant difference in perceived opportunities. Urban teachers recorded a higher grand mean of 3.32 than rural teachers, who recorded 2.98; consequently, the null hypothesis was rejected. Urban teachers may have perceived AI's benefits more strongly because better electricity, connectivity, devices, training and technical support enabled greater exposure to its applications. Scherer et al. (2019) established that perceived usefulness and ease of use influenced teachers' adoption of educational technologies. Better access may therefore have allowed urban teachers to observe AI's usefulness more readily. The finding also reflected the digital divide described by van Dijk (2020), in which location influences access to and meaningful use of technology. The second finding revealed that teachers in both locations perceived all the identified factors as challenges to AI integration. Unreliable electricity received the highest rating among urban teachers (M = 3.16) and rural teachers (M = 3.55), followed by poor internet



Evaluating Teachers' Perceived Opportunities and Challenges on Integrating ... Moses, P. Z. O. & Moses-Promise, O. J. (2026) connectivity and inadequate digital devices. Infrastructure therefore represented the most immediate obstacle to classroom integration. The finding agreed with Bou Zeid and Abouchdid (2026), who highlighted economic and infrastructural barriers to AI-supported educational innovation. Insufficient teacher competence, inadequate training and weak technical support were likewise accepted as challenges. This finding supported Rajapakse et al. (2024), who reported low AI-teaching self-efficacy among public-school teachers, and Tomczyk (2025), who emphasized the technical, pedagogical and ethical competencies required for responsible AI integration. Privacy, inaccurate or biased information, academic dishonesty and dependence on automated answers were also accepted, although they received lower ratings than infrastructure. These concerns showed that AI integration involved ethical as well as material difficulties. Holmes et al. (2022) similarly identified privacy, bias, accountability and human agency as central issues, while Miao et al. (2021) emphasized transparent, responsible and human-centred use. The second hypothesis also revealed a significant location difference. Rural teachers recorded a higher challenge grand mean of 3.31 than the urban mean of 2.94, leading to rejection of the null hypothesis. Rural teachers therefore experienced or anticipated infrastructural, professional and ethical barriers more strongly. This result was consistent with the digital-divide perspective because unequal access and opportunities for meaningful technology use produce different experiences across locations (van Dijk, 2020). It also supported Rogers' (2003) position that innovations do not spread uniformly when resources, institutional support and opportunities for experimentation differ. Together, the findings produced a clear pattern: urban teachers perceived greater opportunities, whereas rural teachers perceived greater challenges. This did not indicate that AI was less relevant to rural education. Rather, it suggested that infrastructure, access and professional support shaped the extent to which teachers could recognize and realize its value. The study therefore extended earlier reviews by providing location-specific evidence from public secondary-school teachers in Delta State (Zhai et al., 2021; Xu & Ouyang, 2022).

Conclusion

The study concluded that teachers in urban and rural public secondary schools recognized the instructional opportunities offered by artificial intelligence but also faced substantial infrastructural, professional and ethical challenges. Urban teachers perceived greater opportunities, whereas rural teachers experienced greater challenges, indicating that effective and equitable AI integration depended on reliable infrastructure, teacher competence, technical support and responsible-use guidelines.

Recommendations

Based on the findings of the Study the following were recommended:

1. The Delta State Government should provide reliable electricity, internet connectivity and digital devices, particularly in rural schools.
2. Teachers should receive regular practical training and technical support on educational AI applications.
3. Schools should establish clear guidelines for ethical, safe and responsible AI use.

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Impact of Internal Auditing on Financial Management in Ohimini Local Government Area, Benue State, Nigeria

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Abstract

This study examined the impact of auditing on financial management with specific focus on Ohimini Local Government Council, Benue State, Nigeria. The study was anchored on Agency Theory, Accountability Theory, and Systems Theory. A descriptive survey research design was adopted. The population comprised 60 staff of the Finance and Supplies Department, Internal Audit Unit, Budget and Planning Unit, and Management of Ohimini LGC. A sample of 65 respondents was selected using Taro Yamane's formula and stratified random sampling. Data were collected through a structured questionnaire and interviews, and analyzed using descriptive statistics, Pearson Product Moment Correlation, and Multiple Regression Analysis with SPSS version 26. Findings revealed that internal auditing has a significant positive relationship with financial accountability, budget discipline, and fraud prevention in Ohimini LGC. The independence of the internal audit unit and implementation of audit recommendations were found to significantly affect financial management outcomes. However, the effectiveness of internal auditing is constrained by inadequate funding, shortage of professional staff, political interference, and poor management response to audit reports. Regression results showed that internal audit variables explained 55.2% of the variation in financial management of the council. The study concluded that internal auditing plays a vital role in enhancing financial management in Ohimini LGC. Internal auditing is an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. According to the Institute of Internal Auditors (IIA). Financial management in local government refers to the planning, organizing, directing, and controlling of financial activities such as revenue generation, budgeting, expenditure control, accounting, and reporting.

KEYWORDS: Impact, Auditing, financial management and Ohimini Local government

Introduction

Auditing and financial management are two interrelated functions that form the backbone of organizational accountability and sustainability. Financial management involves planning, organizing, directing, and controlling the financial activities of an organization to achieve its objectives. This includes budgeting, cash flow management, investment decisions, financial reporting, and compliance with fiscal regulations. Auditing, on the other hand, is the systematic examination of financial records, transactions, processes, and internal controls to determine their accuracy, completeness, and compliance with established policies, laws, and accounting standards. It can be internal, conducted by an organization's own audit unit, or external, carried out by independent professionals. The relationship between auditing and financial management is not merely regulatory but also strategic. Effective auditing strengthens financial management by providing assurance that financial information is reliable and that resources are being used efficiently and for their intended purpose. Without auditing, financial management risks operating without accountability, making it vulnerable to errors, fraud, misallocation of resources, and loss of stakeholder confidence. Core Areas Where Auditing Impacts Financial Management: Accuracy and Reliability of Financial Information Auditing verifies that financial statements reflect the true financial position of the organization. This ensures that managers, investors, donors, and regulators base decisions on credible data. Inaccurate financial data leads to poor budgeting, flawed investment decisions, and misguided strategy. Strengthening Internal Controls Through regular audits, weaknesses in financial controls are identified and addressed. This include segregation of duties, authorization procedures, and reconciliation processes. Strong controls reduce the risk of fraud, theft, and financial leakage. Promoting Compliance Auditing ensures adherence to financial laws, tax regulations, accounting standards like IFRS or IPSAS, and donor or government funding conditions. Non-compliance can result in penalties, loss of funding, or reputational damage. Thus, auditing safeguards the organization legally and financially. Enhancing Transparency and Accountability When financial activities are subject to audit, managers are more likely to exercise prudence and integrity. The knowledge that records will be reviewed creates a culture of accountability. This is especially



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critical in public sector institutions and universities where funds are held in trust for students, government, and the public. Improving Efficiency and Cost Control Performance and value-for-money audits go beyond figures to assess whether resources are used economically, efficiently, and effectively. Findings often highlight waste, duplication, or underutilized assets, enabling management to cut costs and reallocate funds to priority areas. Building Stakeholder Confidence Audited financial reports increase trust among key stakeholders such as governing councils, government, banks, donors, and students. Confidence attracts funding, grants, and partnerships, which are essential for growth and stability. Supporting Strategic Decision-Making Audit reports provide management with objective insights into financial health, risk exposure, and operational gaps. These insights inform budgeting, investment planning, and policy formulation, making financial management more proactive rather than reactive. In summary, auditing is not just a post-mortem check on financial management. It is an integral component that shapes how financial decisions are made, how risks are managed, and how resources are safeguarded. An organization with weak audit practices often experiences weak financial discipline, while one with robust auditing typically enjoys stronger financial health, credibility, and long-term sustainability.

Statement of the Problem

The Impact of Internal Auditing on Financial Management in Ohimini Local Government Council (LGC) Ohimini Local Government Council, like other third-tier governments in Nigeria, is charged with the responsibility of managing public funds to deliver essential services and promote grassroots development. Effective financial management is therefore critical to ensure proper budgeting, accountability, transparency, and judicious use of scarce resources. The Local Government system is guided by financial regulations, the 1999 Constitution, and various state financial instructions that mandate the establishment of internal audit units. The internal audit function is expected to serve as a key mechanism for safeguarding assets, ensuring compliance with financial rules, detecting irregularities, and advising management on financial control weaknesses. However, despite the existence of internal audit departments in most Local Government Councils, including Ohimini LGC, there are recurring concerns over poor financial accountability, budget indiscipline, and misappropriation of funds, weak internal controls, and delayed or unreliable financial reports. Cases of abandoned projects, unaccounted expenditures, and audit queries from external auditors remain prevalent. This raises questions about the effectiveness of the internal audit function and its actual impact on financial management practices within the council. The problem therefore lies in the apparent gap between the expected role of internal auditing and the observed state of financial management in Ohimini LGC. It is unclear whether the internal audit unit is adequately staffed, independent, and empowered to influence financial decisions. Issues such as political interference, inadequate professional training, poor funding of the audit unit, non-implementation of audit recommendations, and weak support from management may undermine the ability of internal auditing to improve financial management outcomes. Consequently, this study seeks to examine the extent to which internal auditing influences financial management in Ohimini LGC. It addresses the problem of whether internal auditing, as currently practiced in the council, contributes meaningfully to financial discipline, accountability, transparency, and efficient resource utilization, or whether structural and operational constraints have rendered it ineffective.

Research Questions

1. To what extent does internal auditing influence financial accountability in Ohimini Local Government Council?
2. How does the independence of the internal audit unit affect financial management practices in Ohimini LGC?
3. What is the relationship between the implementation of internal audit recommendations and budget discipline in Ohimini LGC?

Objectives of the Study

The main objective of the study is to examine the impact of internal auditing on financial management in Ohimini Local Government Council.

Specific Objectives

1. To assess the influence of internal auditing on financial accountability in Ohimini LGC.
2. To determine how the independence of the internal audit unit affects financial management practices in Ohimini LGC.
3. To evaluate the extent to which implementation of internal audit recommendations promotes budget discipline in Ohimini LGC.

Research Hypotheses



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H₀₁: There is no significant relationship between internal auditing and financial accountability in Ohimini LGC.

H₀₂: The independence of the internal audit unit has no significant effect on financial management in Ohimini LGC.

H₀₃: Implementation of internal audit recommendations has no significant impact on budget discipline in Ohimini LGC.

Significance of the Study

The findings of this study will be of benefit to the following stakeholders: Ohimini Local Government Council Management: The study will provide empirical evidence on how internal auditing affects financial management. This will help management strengthen internal controls, improve budget discipline, and ensure better implementation of audit recommendations. Internal Auditors and Finance Officers: It will highlight operational challenges facing the internal audit unit and identify gaps in independence, training, and resources. This can guide reforms to make the audit function more effective. Local Government Service Commission and Oversight Bodies: The study will offer insights for policy review on staffing, funding, and statutory backing for internal audit units across local governments in Benue State. State Government and External Auditors: Results will clarify areas of recurring financial irregularities and show whether weak internal audit practices contribute to external audit queries. This supports better monitoring of local government finances. Residents of Ohimini LGC: Improved financial management arising from effective internal auditing translates to better service delivery, completed projects, and accountability for public funds. Researchers and Academics: The study adds to existing literature on public sector auditing and financial management at the local government level, providing a reference point for future studies in similar contexts.

Scope of the Study

This study focuses on the impact of internal auditing on financial management in Ohimini Local Government Council, Benue State, Nigeria. The study covers key variables including internal audit independence, implementation of audit recommendations, internal control strength, fraud prevention and detection, budget discipline, financial accountability, and transparency. It does not cover external auditing or private sector audit practices.

Literature Review

This section will review all related theories and research work done in related field. It is divided into three basic areas of conceptual framework, theoretical reviews and review of related empirical literatures.

Conceptual Review:

Compliance Audit: An audit that checks whether an organization has followed specific rules, laws, regulations, policies, and standards in its financial transactions and reporting. Focus: “Are we doing things by the book?”

Scope: Compliance with the Public Procurement Act, Financial Regulations, Financial Control and Management Act. Adherence to IPSAS (International Public Sector Accounting Standards) for financial reporting. Compliance with tax laws, budget approval limits, and donor grant conditions. How it works: The auditor compares actual transactions, records, and reports against the required standards, for example, checking if all contracts above ₦5m went through due process, or if the financial statements were prepared using IPSAS accrual basis. Key Output: A compliance report stating “compliant”, “partially compliant”, or “non-compliant” with details of violations and recommendations. Example: Auditing a Ministry to confirm all expenditures were approved by the National Assembly and coded correctly in GIFMIS.

Operational Audit: A review of an organization’s operations, processes, and systems to assess efficiency, effectiveness, and economy in the use of resources. Focus: “Are we doing things the right way and getting value for money?”

Scope: Workflow efficiency in accounts, procurement, payroll, asset management, Use of manpower time, and materials, duplication of effort, bottlenecks, and wastage. How it works: The auditor examines processes, interviews staff, and analyses performance data. They look for delays in payment processing, idle assets, or processes that cost more than they should. Key Output: A report with findings on inefficiency and recommendations to streamline operations, reduce cost, and improve service delivery. Example: Reviewing the procurement process to find why it takes 6 months to buy stationery and suggesting automation to cut it to 2 weeks.

Risk-Based Audit: An audit approach that focuses on identifying, analysing, and mitigating risks that could prevent an organization from achieving its financial and operational objectives. Focus: “Where are the biggest risks of fraud, error, or loss, and are controls adequate?”

Scope: Financial risks: fraud, misstatement, budget overrun. Operational risks: system failure, staff collusion, asset loss.

Compliance risks: penalties for non-compliance with laws. How it works: The auditor first performs a risk assessment to



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rank areas by likelihood and impact. High-risk areas like cash handling, contract awards, and payroll get more audit attention. Low-risk areas get less testing. Controls are tested to see if they reduce risk to an acceptable level. Key Output: Risk register, control gap analysis, and recommendations to strengthen internal controls where risk is high. Example: Identifying that manual cash collection at LGAs is high risk for theft, and recommending Point of Sale systems and daily banking.

Advisory Services: Non-assurance services where the auditor acts as a consultant to provide recommendations for improving financial management, internal controls, and governance. Focus: “How can we do this better?”

Scope: Designing better internal control systems, Improving budget preparation and execution, Implementing IPSAS or new accounting software Fraud prevention frameworks and ethics programs. How it works: Unlike audits, advisory services are proactive and collaborative. The auditor works with management to diagnose problems and co-create solutions. They do not give an audit opinion here. Key Output: Management advisory report, action plan, training, and implementation support. Example: Advising a university on how to transition from cash basis to IPSAS accrual basis, including chart of accounts redesign and staff training.

Budget Discipline & Performance: Budget discipline means spending public funds only as approved in the budget, within limits, and for the intended purpose. Performance means achieving the planned results with those funds. Details :Discipline: No virements without approval, no overspending, no spending outside budget heads. It enforces fiscal control through the budget as a legal document. Performance: Measures whether money spent actually delivered outputs and outcomes. E.g., ₦500m budgeted for 10km road, was it completed on time and to spec? Why it matters: Prevents fiscal deficits, controls waste, ensures resources match policy priorities. Assessed using budget variance analysis and performance indicators.

Transparency in Financial Reporting: Making financial information open, accessible, and understandable to stakeholders so they can see how public money is raised and spent. Details: Requires timely publication of budgets, financial statements, audit reports, and procurement data in formats citizens can understand. Under IPSAS, transparency means full disclosure of assets, liabilities, revenue, expenses, and contingent liabilities without hiding information. Tools: GIFMIS, Open Treasury Portal, Citizens’ Accountability Reports. Why it matters: Builds public trust, allows citizens and CSOs to hold government accountable, reduces suspicion of corruption.

Accountability in Fund Utilization: The obligation of public officials to justify and take responsibility for how public funds are used and the results achieved. Details: Financial accountability: Did officials spend money only for approved purposes with proper documentation? Performance accountability: Did the spending achieve the intended public service outcomes? It involves proper record-keeping, segregation of duties, approvals, and answerability to legislature, auditors, and the public. Why it matters: Ensures public officials act as stewards, not owners, of public funds. Breach leads to sanctions, queries, and surcharges.4. Reduction in Financial Irregularities & Fraud Meaning: Lowering the occurrence of unauthorized, wasteful, or fraudulent use of public funds through preventive and detective controls. Details: Irregularities: Spending without approval, payments without supporting documents, contravention of procurement rules. Fraud: Deliberate deception for personal gain - payroll fraud, contract inflation, ghost workers. Reduction is achieved through strong internal controls, segregation of duties, regular audits, whistleblowing mechanisms, and sanctions. Why it matters: Saves public resources, protects credibility of government, and ensures funds reach intended beneficiaries.

Quality of Financial Records & Statements: The accuracy, completeness, reliability, and compliance of accounting records and financial statements prepared under IPSAS. Details: Qualitative characteristics: Relevance, faithful representation, comparability, verifiability, timeliness, understand ability. Records must be supported by vouchers, receipts, and reconciliations. Statements must be prepared using correct IPSAS standards - accrual basis, proper classification, no omissions. Poor quality leads to qualified audit opinions and loss of credibility. Why it matters: Good quality records enable informed decision-making, effective oversight, and reliable performance evaluation.

Safeguarding of Assets: Protecting public assets from loss, theft, misuse, and unauthorized disposal. Details: Covers cash, bank balances, fixed assets, inventory, investments owned by government. Achieved through asset registers, physical verification, insurance, restricted access, authorization controls, and periodic stock counts. Under IPSAS, assets must be recognized, valued, depreciated, and disclosed correctly. Internal auditing is an independent, objective assurance and consulting activity designed to add value and improve an organization’s operations. According to the Institute of Internal Auditors (IIA), it helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve risk management, control, and governance processes. In the public sector, especially Local Government



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Councils, internal audit serves as a first line of defence against financial irregularities by reviewing transactions before and after payments are made.

Financial management in local government refers to the planning, organizing, directing, and controlling of financial activities such as revenue generation, budgeting, expenditure control, accounting, and reporting. The Financial Memoranda for Local Governments in Nigeria provides the legal framework for financial management at this tier of government. Effective financial management is measured by budget discipline, accountability, transparency, timely reporting, and value for money in service delivery. Internal auditing impacts financial management through three key channels:

Theoretical Review

Agency Theory:

Agency Theory, propounded by Jensen and Meckling (1976), explains the relationship between principals and agents. In the public sector context, the principals are the citizens and taxpayers of Ohimini Local Government Council (LGC), while the agents are the elected officials, management, and finance officers entrusted with public funds. The core problem is agency conflict – agents may pursue self-interest rather than the principal's interest due to information asymmetry. Agents have more information about daily financial operations than principals, creating room for misappropriation, budget indiscipline, and weak accountability. Ohimini LGC receives FAAC allocations, and IGR from markets and motor parks. Without strong monitoring, agents may engage in: Ghost worker payments in payroll gaps. Contract inflation in rural road projects. Unretired advances by revenue officers, non-remittance of IGR by market unions. Internal Audit's Role Prevents diversion by auditing payment vouchers before the Treasurer releases funds, internal audit ensures only approved, budgeted expenditures are paid, enforces accountability: Quarterly audit of departmental vote books and bank reconciliations exposes over-expenditure and unapproved virements. Audit reports to the LGC Audit Committee and Public Accounts Committee create oversight, reducing the tendency of the Chairman or Treasurer to act against public interest. Reduces audit queries: Effective internal audit in Ohimini LGC minimizes external audit queries from the Auditor-General for Local Governments, avoiding sanctions. Theoretical Implication for Ohimini LGC Agency Theory suggests that the cost of monitoring through internal audit is lower than the cost of financial loss from fraud and mismanagement. For Ohimini LGC, a functional internal audit unit, Lowers agency costs by reducing the need for citizens to personally monitor every transaction. Increases trust between the LGC and donor agencies, Improves financial management outcomes – timely financial statements, clean audit opinions, and better budget performance. However, agency conflict persists if the internal auditor lacks independence or if management interferes with audit scope. In Ohimini LGC, if the Internal Auditor reports directly to the Chairman without access to the Legislative Council, the monitoring role is weakened.

Empirical Review:

This section review the works of other related literatures and research work in related field with their findings and gaps. Kayode and Oyeshola (2021) investigated the impact of internal audit on financial performance of deposit money banks in Nigeria using survey data from 16 banks. With 334 valid responses analysed via OLS regression, they found a positive relationship between internal audit and profitability of banks ($r = 28.9\%$). Internal audit reporting channels also had a positive effect on financial performance ($r = 25.5\%$). The study concluded that strengthening internal audit and its reporting channels is important for bank financial performance. Owolabi and Olanrewaju (2020), a study of public sector entities in Ondo State found that internal audit quality variables including competence, objectivity, and performance had a positive and statistically significant relationship with financial controls and effective management controls. Internal audit quality also had a positive significant relationship with public sector service delivery. A 2023 study on Nigerian quoted foods and beverages firms examined internal audit practice and financial reporting quality. Using regression analysis on survey data from Federal Teaching Hospital Ido Ekiti, the finding revealed that audit objectivity has a significant influence on financial reporting quality, while auditor independence, integrity, competence, and confidence did not have positive influence in the public sector. The study recommended that internal auditors maintain neutrality and stay updated with operational procedures. Oyedokun (2023) studied public tertiary institutions in Oyo State, Nigeria. Regression analysis showed that internal control system alone does not significantly affect financial accountability (Adj $R^2 = 12.3\%$, $F = 0.018$). However, value for money audit had a significant effect on financial accountability (Adj $R^2 = 23.4\%$, $F = 0.01$). Combined, internal control and value for money audit had a significant effect on financial accountability (Adj $R^2 = 29.1\%$, $F = 0.01$). The study recommended combining adequate internal control with value for money audit to ensure financial accountability. Madawaki et al. (2021) assessed listed companies on the Nigerian Stock Exchange using 97 usable questionnaires. Findings



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indicated a positive and significant relationship between internal audit quality of work performed, internal control activities, coordination between internal and external auditors, and financial reporting quality, and this was supported by senior management support as a moderator. However, internal audit competency and organisational status showed a negative and insignificant relationship with financial reporting quality. ideas.repec.org6. Audit Quality, Internal Control, and Financial Reporting Quality in Oil and Gas Firms. David et al. (2024) examined listed oil and gas firms in Nigeria from 2013–2022. They emphasized that audit quality is crucial for transparency of financial reporting and preventing fraud. The study noted that weak internal control systems contribute to on-going problems in financial reporting. Ado et al. (2020) was cited showing that robust internal controls improve financial reporting accuracy in Nigerian firms. David et al. (2024) filled a gap by examining how internal control systems moderate the relationship between audit quality and financial reporting quality.

Gap in Literature

While numerous studies address internal auditing in Nigerian local governments, very few focus specifically on Ohimini LGC. Differences in political environment, revenue base, and administrative capacity mean findings from other LGAs may not fully apply. Also, most studies use cross-sectional data and do not track the impact of specific audit reforms over time. This study therefore addresses the contextual gap by providing empirical evidence from Ohimini LGC between 2019 and 2024.

Methodology

A sample size of 60 respondents was determined using Taro Yamane's formula at 5% margin of error. Stratified random sampling was employed to ensure proportional representation across cadres and departments. Primary data were collected using a structured questionnaire developed on a 5-point Likert scale. The instrument measured four dimensions of internal audit: compliance audit, operational audit, risk-based audit, and advisory services; and six indicators of financial management: budget discipline, transparency, accountability, reduction in irregularities, quality of financial records, and asset safeguarding. The questionnaire was validated through expert review and a pilot study. Reliability was confirmed using Cronbach's Alpha, with coefficients exceeding 0.70 for all constructs. Data analysis was performed using SPSS v28. Descriptive statistics including mean, standard deviation, and percentages were used to summarize respondents' perceptions. Inferential statistics comprising Pearson Product Moment Correlation was used to test the relationship between internal audit and financial management, while Multiple Regression Analysis was employed to determine the extent of impact of internal audit dimensions on financial management. Hypotheses were tested at 0.05 level of significance. Ethical considerations were observed. Participation was voluntary, responses were treated with confidentiality, and informed consent was obtained from all respondents.

Research Design:

This study adopts a descriptive survey research design. The design is appropriate because it allows the researcher to collect data from a sample of respondents in order to describe, explain, and analyze the impact of internal auditing on financial management in Ohimini LGC. It enables the collection of both quantitative and qualitative data on the current state of internal audit practices and financial management outcomes.

Population of the Study

The population of this study comprises all staff of Ohimini Local Government Council who are directly involved in financial management and internal audit functions. This includes staff of the Finance and Supplies Department, Internal Audit Unit, Budget and Planning Unit, Revenue Unit, and key management staff such as the Director of Finance and the Local Government Chairman. Based on preliminary inquiry, the total population is estimated at 60 staff.

Data Analysis

The analysis of data collected for the study on the impact of internal auditing on financial management in Ohimini Local Government Council. Data obtained through questionnaires and interviews were analyzed using descriptive and inferential statistics. Out of 65 questionnaires administered, 60 were properly completed and returned, representing a 92.3% response rate. The presentation is done according to the research questions and hypotheses formulated

Table 1: Distribution of Respondents by Department

Department	Frequency	Percentage
TOTAL	60	100

Source: Field survey 2026 unpublished



Table 2: Distribution of Respondents by Years of Experience

Years	Frequency	Percentage
TOTAL	60	100

Source: Field survey 2026 unpublished

Interpretation: Table 1 shows that the majority of respondents are from Finance and Internal Audit, which are keys to the study. Table 2 indicates that 76.7% of respondents have over 6 years' experience, suggesting they are knowledgeable about the council's financial management practices.

Analysis of Research Questions

Decision rule: Mean of 3.0 and above indicates agreement, while mean below 3.0 indicates disagreement. The cut-off point is derived from the 5-point Likert scale: $5+4+3+2+1=3.0$

Research Question One:

To what extent does internal auditing influence financial accountability in Ohimini LGC?

Respondents agreed that internal auditing influences financial accountability in Ohimini LGC through compliance checks, expenditure tracking, and prepayment audit.

Other hypotheses were also tested and they all confirmed that internal auditing influences financial management and accountability.

All hypotheses were tested at 0.05 level of significance using Pearson Product Moment Correlation and Multiple Regression Analysis.

Table 3: Hypothesis Testing & findings

Hypotheses	Test used	Test Statistics	p-value	Decision	Interpretation
H₀₁: There is no significant relationship between internal auditing and financial accountability in Ohimini LGC.	Pearson Correlation	$r = 0.68$	0.000	Reject H ₀₁ :	There is a strong, positive, significant relationship. Better internal auditing is associated with higher financial accountability
H₀₂: The independence of the internal audit unit has no significant effect on financial management in Ohimini LGC	Simple Linear Regression	$\beta = 0.54,$ $t = 5.2$	0.000	Reject H ₀₂ :	Independence of internal audit has a significant positive effect on financial management. $R^2 = 0.32$ means 32% of the variation is explained
H₀₃: Implementation of internal audit recommendations has no significant impact on budget discipline in Ohimini LGC.	Simple Linear Regression	$\beta = 0.61,$ $t = 6.04$	0.000	Reject H ₀₃ :	Implementation of recommendations significantly improves budget discipline. $R^2 = 0.38$ means 38% of the variation is explained.

Source: Field survey 2026 unpublished

$r = 0.68$: Correlation coefficient ranges -1 to +1. 0.68 indicates a strong positive relationship. $\beta = 0.54$: For every 1 unit increase in audit independence, financial management score increases by 0.54 units. $p\text{-value} = 0.000$: Less than 0.05, so the result is statistically significant. It's not due to chance. R^2 : Coefficient of determination. Shows % of variation in the dependent variable explained by the independent variable. This implies there is a significant positive relationship between internal auditing and financial accountability in Ohimini LGC. Key officers interviewed stated that the internal audit unit conducts prepayment audit but faces challenges. A respondent noted: "We check vouchers before payment, but sometimes



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we are under pressure to clear them even when issues are raised.” Another theme was non-implementation of audit recommendations due to lack of management support. These qualitative findings explain why the quantitative impact, though positive, is not as strong as expected.

Discussion of Findings

The findings revealed that internal auditing has a significant positive relationship with financial accountability, budget discipline, and fraud prevention in Ohimini LGC. This aligns with Gololo (2018) who found similar results in Katagum LGA, and with Agency Theory which holds that monitoring reduces agency problems. However, the study also found that weak independence and poor implementation of recommendations limit the full impact of internal audit, consistent with Salim (2018) and Titilayo & Promise (2022) on Nigerian local governments. The regression result showing 55.2% explained variation suggests other factors like political interference and funding also affect financial management in the council

Summary of Findings

Summary of Findings this study examined the impact of internal auditing on financial management in Ohimini Local Government Council, Benue State. Data were collected from 60 respondents across the Finance, Internal Audit, Budget, and Management units using questionnaires and interviews. The study was guided by five research questions and three hypotheses tested at 0.05 level of significance. The major findings of the study are summarized as follows: Internal auditing has a significant positive relationship with financial accountability in Ohimini LGC. Respondents agreed that audit reviews ensure compliance with financial regulations, track expenditure, and reduce unauthorized spending, with a grand mean of 4.12 and correlation coefficient $r = 0.68$, $p < 0.05$. The independence of the internal audit unit significantly affects financial management practices. Where auditors are free from interference, financial reports are more reliable and controls are stronger. However, the study found that independence is often compromised due to the reporting structure and political pressure. Implementation of internal audit recommendations has a significant impact on budget discipline. The regression analysis showed that audit recommendations, when implemented, reduce budget variances and improve expenditure control. Yet, non-implementation remains a major challenge due to weak management commitment. Key challenges limiting internal audit effectiveness include inadequate funding, shortage of professionally trained staff, lack of modern audit tools, political interference, and poor management response to audit queries. Internal auditing contributes to fraud prevention and detection in Ohimini LGC, especially through prepayment audit. However, its impact is limited by delayed audits and the inability to sanction offenders. Overall, internal audit variables explained 55.2% of the variation in financial management of Ohimini LGC, indicating a strong but not exclusive influence. Other factors such as political environment and statutory allocations also affect financial management outcomes

Conclusion

Based on the findings, the study concludes that internal auditing plays a vital role in enhancing financial management in Ohimini Local Government Council. It promotes accountability, supports budget discipline, and helps in detecting financial irregularities. The relationship between internal auditing and financial management is positive and statistically significant. However, the full potential of internal auditing has not been realized in Ohimini LGC due to institutional and operational constraints. Weak independence, inadequate capacity, poor funding, and non-implementation of audit recommendations undermine the effectiveness of the internal audit function. Therefore, while internal auditing impacts financial management, its contribution is below optimal level. In line with Agency Theory, internal audit reduces information asymmetry and aligns the actions of local government officials with public interest. But as Systems Theory suggests, the audit subsystem cannot function effectively if other components of the local government system are weak

Recommendations

Based on the findings and conclusion, the following recommendations were made:

1. To the Management of Ohimini LGC: The council should strengthen the independence of the internal audit unit by making it report directly to the Local Government Chairman or the Audit Committee, not the Director of Finance. Management should also ensure timely implementation of audit recommendations and provide feedback on actions taken.



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2. To the Benue State Local Government Service Commission: The Commission should review the staffing and training policy for internal auditors. Regular professional training, certification support, and recruitment of qualified accountants into the audit unit should be prioritized.
3. To the State Government: Adequate budgetary provision should be made for the internal audit unit to procure modern audit tools, including computer-assisted audit software. The state should also enforce sanctions for non-implementation of audit recommendations and for financial infractions identified by internal audit.
4. To Internal Auditors in Ohimini LGC: Auditors should adopt risk-based and systems audit approaches rather than relying only on vouching. They should also improve documentation and follow up on previous recommendations to ensure closure of audit issues.
5. To Oversight Bodies: The Office of the Auditor-General for Local Governments and the State House of Assembly Committee on Public Accounts should hold management accountable for unresolved internal audit queries. This will increase the relevance of internal audit reports.
6. For Policy: The Financial Memoranda should be reviewed to grant internal audit units operational and administrative independence. A local government audit committee comprising external members should be established to review internal audit reports and ensure management action.

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A Historical Study on Friday Sermon Presentation in Arabic Language to Non-Arabic Speaking Congregations in Kano Metropolis, Kano State, Nigeria

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Abstract

This study examines the role of the Friday sermon in promoting understanding Islam among worshippers. It focuses attention on the impacts of reciting the sermon in Hausa speaking environment, such as the Kano Metropolis. The need and possibility of reciting the sermon in languages other than Arabic is highlighted as well as its position in islam. A total of twenty-one mosques within the Kano metropolis were selected for the study. In the presentation of the statistical analysis, two sets of data were used. The first data was collected from the Imams while the second was selected from the congregation of listeners. A self-designed opinioned questionnaire was used to collect relevant data from the subjects. The data were subjected to frequencies and the X^2 statistical analysis. From the analysis of the data collected for this study, it was observed that the major problem related to the recitation of the Friday sermon in Arabic to non-Arabic speaking congregation, the inability for most members of the congregation to understand what is being said in the sermon. The findings that emerged were used to make recommendations, which include refresher courses for the Imams, the translation of the sermon before or after the Friday prayer and training and retraining of imams on the philosophy, objective and methodology of delivering sermons.

Keywords: Friday Sermon (Khutbah), Arabic Language, Non-Arabic Congregations, Mosques, Kano State.

Introduction

Sufi, (1977:141) explained that the Friday prayer was made obligatory in the early days of Islam when the Prophet (SAW) was in Makkah but Muslims could not observe it because they were under persecution by the leaders of Makkah. It was not until the first converts from Madinah accepted Islam that the Prophet ordered there leader, named As'ad bin Zurara to conduct the Friday prayer when they went back to Madinah and this was the first Friday prayer in Islam. But the Prophet (SAW) observed his first Friday prayer, when he migrated to Madinah. This prayer was conducted in the month of Rabi'ul Auwal of the first year of the Hijrah at an open ground belonging to the clan of Banu Saleem. Later, the people of the area built a mosque in the place. Shaukani, (2003: 2/291) explained that the first Friday prayer to be conducted outside Madinah after the first one in the mosque of the Prophet was that of the mosque of Abdul Qais in a town named Juwai in a region called Bahrain. This second Friday prayer was done via the second Khalifah, Umar Bin Al-Khattab. Muslims in Egypt also started to perform Friday prayer by the permission of Umar and Uthman, the second and third Khalifah, respectively. From that time on, Friday mosques continue to spread in Muslim countries.

History of Friday Mosques in Kano

The history of the Mosque in Kano can be traced back to the early days of introducing Islam to Hausaland before the Jihad of Shehu Uthman bin Fodio. The Wangarawa Muslim scholars who migrated from Mali were believed to introduce Islam to Kano in the fourteenth century C.E during the reign of the king of Kano, popularly known as Sarki Yaji (1349 – 1385 C.E) who embraced Islam from the Wangarawa Ulama. Having accepted Islam Sarki Yaji was advised by the Wangarawa Mallams to build a Mosque. This was the first official Mosque that was built in Kano. The Imam whose name was Gurdumus was appointed by the Wangarawa Mallams with the approval of Sarki Yaji (Wada, 1998:27-28). Later, more mosques were built in different parts of Kano with Wangarawa Mallams appointed as Imams. The increase in the number of Mosque, automatically led to the emergence of many Imams, which resulted in the appointment of a Wangarawa Mallam, known as Imam Mandawari, as the first-Chief Imam of Kano. But the most remarkable development of Mosques in the period of Hausa rulers was during the reign of Sarki Muhammadu Rumfa (1390/1463 C.E) who contributed immensely to the development of Islamic institutions in Kano. One of the factors that led to this development was the migration of foreign



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scholars such as the second batch of Wangarawa Mallams, scholars from Borno and Fulani scholars from the Mali empire as well as scholars from North Africa otherwise known as Sheriffs due to the belief that they were descendants of the Holy Prophet (SAW). The Sheriffs were led by Muhammad Ibn Abdulkarim al-Maghili, who came to Kano in 1492 C.E. Among the contributions of these scholars was the increase in the construction of Mosques as centres of learning. It was through the guidance of al-Maghili that Sarki Muhammadu Rumfa built the first official Friday Mosque near Kofar Nassarawa and later relocated to its present location near Emir's Palace in 1807 C.E after the Danfodio Jihad. The position of the Qibla of this Mosque was re-set by Sheikh Abdullahi bin Fodio who was in Kano in 1807. This Friday Mosque, which was a symbol of traditional Hausa architecture remains unchanged for about a century. When the Emir of Kano Alhaji Abdullahi Bayero (1926-1953) became the Emir of Kano, he demolished this Mosque and in its place a new, magnificent one was constructed in modern architecture. The building of this Mosque which was started in 1943 and completed in 1951, became the pride of Kano people and one of the centres of tourism up to the present day (Wada, 1998:85).

Proliferation of Friday Mosques in Kano

With the overwhelming increase in the population of Kano, only one Friday Mosque could no more accommodate the large number of worshipers that were always on the increase. So the Emir of Kano, Alhaji Ado Bayero, after due consultation with the Kano Council of Ulama approved the construction of an additional Friday Mosque at Fagge Quarters in the Eastern part of Kano. The foundation of the Mosque was laid by the Emir in October 1967 and was commissioned in 1969 (Paden. 1973:205). The Mosque was later named Abdullahi Bayero, the ex-Emir of Kano who first initiated the idea of constructing an additional Friday Mosque in Kano. In 1971, some Muslim scholars from Bayero University Kano started to discuss the idea of building a Friday Mosque within the premises of the University. Some of these scholars included: Dr. Sani Zahraaddeen, Dr. Hassan Ibrahim Gwarzo, Dr. Umar Jah and others. The Mosque was built in 1978 by contribution from the Muslim community in and outside Kano including the Muslim lecturers from the University who contributed from their monthly salary. The mosque was officially opened by the Emir of Kano, Alhaji Ado Bayero on 9th March 1979 (Gambo. 1990). The opening of these two Friday Mosques paved the way for people who live in the outskirts of Kano city to seek the approval of the Emir to build Friday Mosque in their area with the plea that the existing Friday Mosques are far away from their areas. To ease this difficulty for them, the Emir always listens to their grievances. In this way, new Friday Mosques continue to spring up in Kano. Some of these new Friday Mosques are:

1. Kurnar Asabe Jumu'ah Mosque: Situated in the Northern part of Kano was built in 1975.
2. Fityat ad-Deen Jumu'ah Mosque: Built in 1976; this mosque was built by the Yoruba Muslim community in Kano.
3. Yar Akwa Jum'ah Mosque: This Mosque was constructed in 1979.
4. Murtala Muhammad Jumah Mosque: This Mosque was built in 1980 and was named after the former Nigerian Head of State, who was a Kano indigene

Weekly Friday Sermon

Majority of the Muslim jurists agreed that delivering the Friday sermon is obligatory. So, the Friday prayer cannot be conducted without the sermon. Their argument is based on a number of reasons, which include; The Holy Qur'an enjoins Muslims to listen to the sermon in the following verse: "O ye who believe! When the call is proclaimed to pray on Friday, hasten earnestly to the remembrance of Allah and leave off business and (traffic); that is best for you if ye but know" (Q. 62:9). Qurtubi (1993, 9/97-98) explains that the word 'dhikr' (remembrance in the verse refers to the sermon and the prayer. Sabiq (1998, 1/352) said that Muslim scholars told us that the Prophet (SAW) used to deliver a sermon every Friday. It is also reported from Abdullahi bin Umar who said; "The Prophet of Allah used to deliver the Friday sermon while standing, then sat down and then stood up (to deliver the second part of the sermon). (Muslim. n.d. 3/9) This Hadith indicates that the Prophet used to deliver a sermon every Friday. Ibn AlArabi commenting on this verse (Quran 62:11) says; "Majority of our scholars (Maliki scholars) said that this verse is an indication that, Allah would not have blamed the companions for leaving the Mosque while the sermon was being delivered, for people are only blamed when they reject a compulsory act" (Ibn AlArabi. 2002: 4/247).

Status of the Friday Sermon According to Jurists

There are different opinions among jurists with regard to the status of the Friday sermon as to whether it is part of the prayer or it is a condition for the validation of the prayer or not. If for instance, a Friday prayer is to be conducted without



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a sermon should the prayer serve as the Friday prayer or not? There are two legal opinions concerning this issue and these are:

1. The Sermon is Compulsory:

This is the view of the majority of the Muslim scholars, including the four schools of law.

Sabiq, (1998: 1/352) explains these views as follows: (i) Since the Quran commands the Muslims to listen to the sermon (Q. 62:9) delivering is compulsory. (ii) It is reported that the Prophet (SAW) used to deliver his sermons while standing. This shows that he never observed the Friday prayer without delivering the sermons. (iii) The scholars explain that since the Prophet ordered Muslims to pray the way he prayed and always delivered the sermon on Friday, so Muslim must do it the way he did it, and if the Prophet had never observed the Friday prayer without delivering the sermon, so it is compulsory for Muslims to deliver the sermon every Friday

2. The Sermon is not compulsory:

The Muslim scholars who said that the sermon is not compulsory are in the minority. They disagree with the view of the majority in the following ways (Shaukani, 2003, 2/330): (i) To say that the sermon is compulsory simply because the Prophet used to deliver it every Friday is not a reason, for a normal action of the Prophet does not always make an act of worship compulsory. (ii) The Hadith that commanded Muslims to pray as the Prophet did has no relation with the sermon, it only refers to the prayer. (iii) The verse (Q6:9) that enjoins the Muslims to hasten to dhikr or remembrance of Allah also refers to the prayer and not the sermon which show that it is not compulsory. (iv) The sermon is not part of the Friday prayer, they said that if for instance, the Friday prayer is to be observed without delivering the sermon the prayer is valid. To support their argument, the scholars of this opinion, quoted a Hadith where the prophet said, "Whoever gets one raka'a (segment) of the Friday prayer has indeed got the whole Friday prayer" Nasai (197: 2/11)

Out of these two views, the best one can be said to be the view of the majority of scholars who said that delivering the Friday sermon is a must. This is because their argument is based on a clear text of the Quran and sunnah, unlike the other group who depend more on analogical analysis.

Conditions for the Friday Sermon

Muslim scholars like Qurtubi, (1993: 9/99-107) and Ahmad, (1996:111) have stated the conditions for the validity of Friday sermons as follows:

1. The Sermon has to be Recited in a Given Time: As reported by Anas bin Malik, 'The Prophet used to pray on Friday when the sun bends down' (Bukhari 2/12-13). It is also reported that the four pious caliphs and other companions of the Prophet used to pray when the sun declines.
2. Sermon is to be Delivered before the Prayer: Sufi, (1997:147) said that 'it is a consensus among the Muslim scholars that the sermon has to be delivered before the segments (Raka'a) prayer is conducted. If an Imam was to deliver the sermon after the prayer, the prayer has to be observed again. The reason for this is that; the Prophet (SAW) used to deliver the sermon before the prayer, and this is the tradition of his sahabah
3. The Sermon has to be recited in congregation: This is also a consensus among the Ulama that the Friday sermon must be delivered in a congregation, though they differ in the specific number of the people to be present when the sermon is delivered. But they all agree that it has to be delivered in congregation due to the command by the Prophet; As reported by Tariq bin Shihab, the Prophet (SAW) said; 'The Friday prayer is an obligatory right on every Muslim in a congregation. Abu Dawud. (n.d, 1/280).
4. The Sermon must be Recited Aloud: It is required for the Imam to deliver the sermon in a way that the congregation may hear it. This is because the Quran enjoins the congregation to listen to the sermon and to ponder over it. (Q 62:9). So it is compulsory for the Imam to raise his voice when delivering the sermon.
5. The Imam should be a Man: According to Ibn Qudama (2004), only a man can lead the Friday prayer because it is not obligatory for women, though they are allowed to attend the mosque, listen to the sermon and pray with their men counterparts. This is the Muslim tradition right from the time of the Prophet to the present time.

Statement of the Problem

Research Findings and observations indicate that there are a lot of Friday mosques in Kano with Imams of different qualifications. These Friday mosques are faced with one problem or another. Some of these problems include; some Imams are unqualified, so they find it difficult to deliver the sermon in standard Arabic, and most of them cannot prepare sermon



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of their own; they depend on sermons written by past scholars. This attitude often makes the sermon irrelevant to the needs of their society. Majority of the members of the Friday congregation do not understand Arabic. The sermon is expected to provide knowledge and awareness to the generality of Muslims with regard to current issues or events taking place in the Muslim world in general, and the local society in particular, with the aim of assisting Muslims to overcome their educational, social and political problems. Thus, delivering it in a language they do not understand will only result in the waste of human resources or misguided information. Lack of basic facilities or inadequate facilities, such as effective loudspeakers and electric generators also make it difficult for the congregation to listen to the sermon properly. It is due to the above problems that the researcher is prompted to carry out this study in order to compare the impact of delivering the sermon in Arabic to the Friday congregation and the possibility of delivering it in the local language of the community.

Objective of the Study

This research work titled: An assessment of reciting the Friday sermon in Arabic to non-Arabic speaking congregation in some selected mosques in the Kano metropolis, is carried out to discover;

1. the significance or otherwise the sermon in the day-to-day affairs of Muslims.
2. To investigate whether it is allowed by the primary sources of Islamic law to deliver the Friday sermon in languages other than Arabic.
3. discuss these opinions with the intention of finding solutions to the problem of reciting the sermon in Arabic to those who don't understand the language.

Research Methodology

The methodology used in gathering data for the problem under investigation is designed to investigate the impact of reciting the Friday Sermon in Arabic to non-Arabic speaking congregations in Kano metropolis. It discusses the research design, the population for the study, the sample and sampling instrument for data collection, the procedures for data collection and analysis.

Research Design

The survey method was employed for this paper. It is a method usually adopted when handling a large population, especially on issues of the moment that involve the systematic collection of data from the population of the study through the use of questionnaires, interviews, observation e.t.c (Razaq and Ajayi. 2000:16). This method is used because the survey involves collecting information from a large population located in different areas in a natural setting. Information from records of Jumu'ah Mosques and questionnaire was designed to investigate the impact of reciting the Friday Khutbah in Arabic to non-Arabic speaking congregation in Kano metropolis. Research design is important so as to determine the type of data required, and how to collect and collate them, as well as how to analyze and measure them (Razaq and Ajayi 2000:16). It is a method that has to be done in the field. The data are derived from a questionnaire and the attempts to document current condition or attitudes to describe what existed.

Data Collection

The sources of the data collected in this research were divided into two categories. The primary sources and the secondary sources were basically used. The primary sources constitute the use of the interview and physical observation by the researcher himself after a visit to some of the Friday Mosques and during the Friday prayer sessions. The researcher was able to see by himself some of the relevant aspects of Muslim life that are not attaining justice by the mode of the (Khutbah) sermons delivery in most of the mosques visited. The secondary sources of that data collected during this research work involved the use of the original and readily made available information on the problem under consideration. The secondary methods were derived from pamphlets, textbooks and papers presented during sermons and lectures on the problems and solutions to the problems of the delivery of the sermon in Arabic. Data collected under this research work were meant to educate Muslims on the relevance of Khutbah (sermons) in their lives. Data were collected together for the purpose of analysis. At the end, the information provided in this research work was analysed. Collection of the data during this research work was faster because the research was carried out in an Islamic society highly dominated with many resource persons and mosques from which valuable information can be gathered. Likewise, the researcher restricted himself to Friday Mosques where most people are considered to be non-Arabic literate.



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Population of The Study

The population used in the conduct of this study comprised the Imams and some members of the congregations of some selected Friday mosques within the seven local governments in the Kano metropolis.

Sample and Sampling Techniques

The purposive sampling technique was adopted to arrive at the sample that was used in this study. Out of 44 local government areas in Kano state seven are located within the metropolis. From each of the seven local government areas three Friday mosques were selected. The Imams of the Friday mosques and some selected followers were given the questionnaire.

The following are the stratification of the Friday mosques in Kano metropolis in their respective local government areas. Kano Municipal Local Government Area; (i) Kano Central Mosque, (ii) Sharada Friday Mosque, (iii) Sheikh Ahmad Tijjani Friday Mosque; Dala Local Government Area (i) Kurna Friday Mosque (ii) Alhassan Dantata Friday Mosque (iii) Taibah Friday Mosque (iv) Muhammad Rabiu Friday Mosque; Gwale Local Government Area; (i) BUK Friday Mosque (ii) Ado Bayero Friday Mosque (iii) Almunata al-Islamy Friday Mosque (iv) Usman bin Affan Friday Mosque; Kumbotso Local Government Area; (i) Kumbotso Central Mosque (ii) Zawaciki Friday Mosque (iii) Ibrahim Mijinyawa Friday Mosque; Tarauni Local Government Area; (i) Tarauni Central Mosque (ii) Sahabah Friday Mosque (iii) Yar'akwa Friday Mosque (iv) Naibawa Friday Mosque; Fagge Local Government Area; (i) Abdullahi Bayero Friday Mosque (ii) Abdullahi bin Abbas Friday Mosque (iii) Ansaruddeen Friday Mosque (iv) Bokavu Barrack Friday Mosque; Nassarawa Local Government Area; (i) Da'awa Friday Mosque (ii) Hotoro Friday Mosque (iii) Tudun Wada Friday Mosque (iv) Tudun Murtala Friday Mosque

Three Friday mosques were selected from each local government area using the purposive sampling technique, on the basis that they cover the seven local government areas in Kano metropolis.

Instrumentation

The researcher described here the various instruments used in collecting the data, how the instruments were developed and their features. Self-developed questionnaire were used to gather information. Copies were given to the Imams of Friday mosques on one hand and the members of the congregations on the other. The questionnaire so designed was divided into two parts with either question or statement regarding the opinion of the Imams and the listeners on the impact of reciting the Friday sermon in Arabic to non-Arabic speaking congregation. The first part of the questionnaire contains questions on personal information about age, the highest academic qualification, working experience and the history of the establishment of the mosque. The second part contains question and statement on the method of delivering the sermon, how it facilitates learning, the language is supposed to be delivered and whether listening to the sermon influence understanding of the congregation. The instruments comprised items to which the subjects were required to respond to with a tick [✓] in the appropriate column. The instrument is a four (4points) like-scale comprising Strongly Agree, Agree, Strongly Disagree and Disagree.

Validity

To ensure the context validity of the instruments, it was scrutinized by the experts after which some items were either retained, eliminated or new ones added.

Data Analysis

The responses were collated by initially using percentages which were later subjected to X² chi-square statistics. Although all the questionnaire may not be returned; the few returned were analysed.

Administration

In administering the instrument, the researcher employed the services of colleagues and students. A total of 140 questionnaires were distributed and 125 were returned, and thereafter analysed for the study.

Findings and Discussion

1. The major problem of reciting the sermon in Arabic is that most members of the congregation do not understand what is being preached.
2. There is a significant difference between the Imams and the congregation on the preferred use of Arabic in reciting the Friday Sermon within the metropolis. While the Imams have a high preference for the use of the Arabic language, the congregation were less enthusiastic.



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3. Both Imams and the congregation agreed that using the Arabic language in the recitation of the Friday Sermon has significant impact on the listeners.
4. If given the option, the congregation would have preferred the sermon to be delivered in Hausa.
5. The Imams acknowledge the fact that their sermon in Arabic was not understood by most of their listeners.
6. The Imams would also prefer the use of Hausa in the recitation of the Friday Sermon if they have the alternative.

From the analysis of the data collected for this study, it was observed that the major problems related to reciting the Friday Sermon in Arabic to non-Arabic speaking congregations is their inability to understand what was being said. From the observations, the Imams preferred the recitation of the sermon in Arabic though they are aware that most of the congregation did not understand the language. This preference on the part of the Imams is in line with Jazari (1972:391), where it was observed that it is better to recite the sermon in Arabic. However, it was not categorically clear whether the use of the Arabic language is necessarily a compulsion. This stance is also in line with Imam Sufi (1977:147), where it was observed that one of the conditions of the sermon is that it must be recited in Arabic and that to deliver it in any other language makes it invalid. It was pointed out that where the congregation does not understand Arabic, the Imam should still deliver his sermon in it. From his observation, delivering the sermon in Arabic was so important that he suggested that if in a Muslim town no one can deliver the sermon in Arabic, the Friday prayer should not be observed. Sufi (1977:147) quoting from the Hanbali scholars, said that it is compulsory to read the sermon in Arabic, that if the Imam is fluent in Arabic and majority of the people will understand the language. This was a condition attached to using the Arabic language in the recitation of the sermon. In the observation, it was opined that if all the people do not understand Arabic, the Imam should deliver the sermon in their local language. This, thus makes the use of Arabic for the Friday sermon optional. This follows the Hanafi and Shafi'i scholars who explained that if the Imam is able to deliver the sermon in Arabic, he should do so but if he cannot, he should deliver it in the local language of the congregation (Ahmad 1996:112). It was however observed that it was not only the Imams that prefer the use of the Arabic language in the recitation of the sermon. It was observed that even the members of the congregation were of the opinion that reciting the sermon in Arabic has a significant impact on the listeners. Apart from this expressed opinion, the congregations also were of the opinion that the sermon should be recited in Arabic. This observation is in line with the Malik and Shafi'i schools where it was observed that the Friday Sermon must be delivered in Arabic regardless of whether the congregation understands it or not. The reason adduced for this was that the Prophet (SAW) and his Sahaba (RA) used to deliver their sermons in Arabic. In the opinion of the two groups involved in this study, if an option is to be made available with regard to the language of preference, they would rather have the Hausa language for the recitation of the sermon.

Conclusion

The major problem identified with the recitation of the sermon in Arabic to non-Arabic speaking group in the metropolis was mainly that of understanding. The congregation in most of the mosques within the metropolis did not really understand the Arabic language in which the Friday Sermon is delivered. However, the two groups agreed that delivering the Friday Sermon in Arabic has a significant impact on the listeners and the Imams were of the opinion that it enhanced learning in the religion.

Recommendations

On the basis of the findings of this study the following recommendations are made:

1. The validity of reciting the Friday Sermon in a Non-Arabic language should be looked into since there does not seem to be a categorical prohibition to it.
2. An in-depth study of Islamic jurisprudence should be encouraged among the Imams, so that areas of disagreements by the various schools of law can be resolved without undue acrimony.
3. Workshops and seminars should be organized for public enlightenment among the Imams to prepare the sermon that will improve the understanding of the listeners.
4. Training and retraining Imams on the philosophy, objectives and methodology of the sermon.
5. There is the need for continued emphasis on the use of community centred sermon. This no doubt, would promote greater understanding of the religion.

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Effect of Project-Based Teaching Method on Academic Performance in Civic Education Concept among Senior Secondary School Students in Adamawa State, Nigeria

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Abstract

This study investigated the effect of the project-based teaching method on students' academic performance in Civic Education in senior secondary schools of Adamawa State, Nigeria. The research was guided by two research questions and three null hypotheses tested at a 0.05 level of significance. A quasi-experimental design, specifically the pretest-posttest non-equivalent control group design, was employed. The population of the study was 50,782 Senior Secondary School II students offering Civic Education across five education zones of Adamawa State. A sample of 265 SS II students (142 males and 123 females) was drawn from four intact classes using purposive and stratified random sampling techniques. The instrument for data collection was the Civic Education Performance Test (CEPT), consisting of 50 multiple-choice items adapted from WAEC Civic Education past questions (2020–2025). The instrument was validated through face and content validation by experts, and its reliability was established using Kuder-Richardson Formula 21 (KR-21) using the split-half method, yielding a coefficient of 0.82. The item analysis of the 50-item Civic Education Performance Test (CEPT) revealed difficulty indices (p-values) ranging from 0.33 to 0.80 and discrimination indices (D-values) ranging from 0.25 to 0.68, indicating that the majority of items were of moderate difficulty and had good to excellent discriminating power, with no items requiring major revision based on the established criteria. Data were analyzed using mean and standard deviation to answer research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at the 0.05 alpha level. The findings revealed that: there was a statistically significant effect of project-based teaching method and conventional method on students' academic performance, $F(1,262)=8682.93$, $p<0.001$, with students taught using project-based method performing significantly better than those taught using conventional method; gender had a statistically significant effect on academic performance, $F(1,140)=6.93$, $p=0.009$, indicating that male students performed better than female students when taught civic education using project-based method; and there was a statistically significant interaction effect between teaching method (project-based and conventional methods) and gender on students' academic performance, $F(3,260)=2918.11$, $p<0.001$. The study concluded that the project-based teaching method has a significant positive effect on students' academic performance in Civic Education in senior secondary schools of Adamawa state, but male students performed better than female students when taught civic education using the project-based method. Recommendations include that Civic Education teachers should adopt project-based learning as an instructional strategy and design inclusive project tasks that equally engage both male and female students.

Keywords: Project-Based Teaching Method, Academic Performance, and Gender

Introduction

The persistent poor academic performance of students in Civic Education at the senior secondary school level has become a major concern to educators, curriculum planners, and educational researchers in Nigeria. Examination reports and school records indicate that many students consistently perform below expectations in Civic Education, despite the subject's relevance to democratic development and national cohesion (WAEC, 2022). This situation has raised questions about the effectiveness of instructional practices used in teaching the subject. Civic Education was introduced into the Nigerian



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curriculum to instill democratic values, civic responsibility, respect for human rights, and national consciousness among young citizens (Nwankwo, 2020). However, classroom evidence suggests that these objectives are yet to be fully realized in many secondary schools. Students often demonstrate superficial understanding of civic concepts and struggle to apply learned knowledge to real-life civic situations (Falade & Adeyemi, 2020). The continued decline in students' academic performance serves as the major prompt for conducting this research. Scholars argue that ineffective teaching methods contribute significantly to this problem (Adebayo & Yusuf, 2019). Consequently, there is growing interest in exploring innovative instructional strategies capable of improving learning outcomes in Civic Education. This concern forms the foundation for the present study. From a global perspective, poor academic performance in Civic Education has been widely reported across both developed and developing countries. Studies indicate that Civic Education is frequently taught using teacher-centered approaches that emphasize theoretical content rather than practical civic engagement (Kerr & Print, 2018). As a result, students often perceive the subject as abstract, boring, and disconnected from their everyday experiences. This perception negatively affects students' motivation, comprehension, and academic performance (Hoskins et al., 2021). International assessments have revealed significant gaps in students' civic knowledge and participatory skills (Organisation for Economic Co-operation and Development, 2021). In response, global education reforms emphasize learner-centered instructional strategies that promote active participation and experiential learning. Countries that have adopted innovative approaches such as project-based learning report improved student engagement and academic performance in Civic Education (United Nations Educational, Scientific and Cultural Organization, 2020). However, in regions where traditional teaching methods remain dominant, students continue to perform poorly. The global discourse therefore highlights the need for instructional innovation. These global concerns provide a useful framework for understanding similar challenges in Nigeria. In Nigeria, over the nine-year period, the percentage of students achieving credit passes (A1-C6) has fluctuated but remained generally low, with the highest being 35.35% in 2024 and the lowest being 11.57% in 2019 and 13.23% in 2025. More alarmingly, the percentage of students recording poor achievements (D7-F9) has consistently exceeded 60% in most years, with the worst performances recorded in 2019 (88.4%), 2025 (86.8%), and 2017 (80.6%). While there was a slight improvement in 2020 (70.1%), 2022 (73.6%), and 2024 (64.7%), the overall trend indicates that a significant majority of students in Adamawa State continue to perform poorly in Civic Education. These national and regional challenges underscore the need to re-examine teaching strategies used in Civic Education classrooms.

Academic performance refers to the measurable outcomes of learning in terms of students' knowledge, understanding, skills, and attitudes, usually assessed through tests, examinations, and classroom activities. In Civic Education, academic performance extends beyond test scores to include students' ability to analyze social issues, demonstrate civic competence, and apply civic knowledge responsibly (Adeyemi, 2018). Poor academic performance, therefore, indicates a disconnect between instructional objectives and learning outcomes. Studies reveal that many students are unable to interpret civic concepts meaningfully or relate them to societal realities (Falade & Adeyemi, 2020). Academic performance is influenced by several factors, including teaching methods, learner motivation, and classroom environment. Among these factors, instructional strategy plays a critical role. When teaching methods fail to engage learners, academic performance tends to decline. Improving students' academic performance therefore requires effective and engaging teaching approaches. Civic Education is a discipline designed to prepare learners for responsible and active participation in civic and political life. It equips students with knowledge of democratic principles, human rights, the rule of law, and civic responsibilities (Nwankwo, 2020). The subject also aims to develop values such as tolerance, patriotism, accountability, and respect for diversity. In Nigeria, Civic Education serves as a tool for promoting national unity and addressing social challenges such as corruption and human rights abuses. However, the performance of these objectives depends largely on how the subject is taught. When instruction is purely theoretical, students fail to internalize civic values. Civic Education therefore requires active learner engagement to be meaningful. This highlights the importance of appropriate teaching strategies. Teaching methods refer to the systematic strategies and procedures used by teachers to facilitate learning and achieve instructional objectives. In Civic Education, teaching methods significantly influence students' understanding and value acquisition. The conventional method is the most commonly used instructional method in Nigerian secondary schools (Okeke, 2017). This method places the teacher at the center of the learning process while students remain passive recipients of information. Although it allows coverage of large content within a short time, it discourages interaction and critical thinking. Students taught primarily through conventional often exhibit low interest and poor academic performance. In contrast, learner-



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centered methods promote active participation and meaningful learning. The project-based teaching method is an instructional method that engages students in investigating and solving real-life problems through collaborative projects. It encourages inquiry, creativity, and independent learning (Bell, 2019). In Civic Education, project-based learning allows students to explore civic issues within their communities, thereby making learning relevant and practical (Eze & Obi, 2022). This method shifts the teacher's role from instructor to facilitator while learners take responsibility for their learning. Research indicates that project-based learning enhances retention, understanding of complex concepts, and academic performance (UNESCO, 2020). It also promotes teamwork and communication skills, which are essential civic competencies. These benefits make project-based teaching method suitable for Civic Education instruction. Gender is another variable that may influence students' academic performance. Some studies suggest that male students perform better in Civic Education due to greater exposure to civic activities, while others report no significant gender differences (Ahmed & Sule, 2018; Musa & Danjuma, 2021). These mixed findings indicate the need for further investigation. Gender may also affect how students respond to different teaching methods. Project-based learning provides equal opportunities for participation among male and female students. Understanding gender differences is important for achieving equitable learning outcomes. Therefore, international and regional studies further reinforce the effectiveness of project-based learning in improving students' academic performance and civic competence.

Purpose of the Study

The main purpose of this study was to investigate the effect of the project-based teaching method on students' academic performance in Civic Education in senior secondary schools in Adamawa State, Nigeria. The specific objectives of this study were to:

1. Determine the effect of the project-based teaching method on student academic performance when taught civic education and those taught using conventional method.
2. Determine the effect of gender on student academic performance when taught civic education using the project-based teaching method.
3. Determine the interaction effect of teaching methods and gender on students' academic performance in civic education in senior secondary schools of Adamawa State, Nigeria.

Research Questions

The following research questions were raised to guide the study:

1. What is pretest and posttest mean score differences of the project-based teaching method on student academic performance when taught civic education and those taught using the conventional method?
2. What is the pretest and posttest mean score differences of gender on student academic performance when taught civic education using the project-based teaching method?

Hypotheses

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

- H01:** There is no significant effect of project-based teaching method on student academic performance when taught civic education and those taught using conventional method.
- H02:** There is no significant effect of gender on student academic performance when taught civic education using project-based teaching method.
- H03:** There is no significant interaction effect of teaching methods and gender on students' academic performance in civic education in senior secondary schools of Adamawa state Nigeria.

Research Methodology

This study employed a quasi-experimental design, specifically the pretest-posttest non-equivalent control group design, to investigate the effects of teaching methods on students' academic performance in Civic Education. The independent variable was teaching method (project-based versus conventional), the dependent variable was academic performance, and gender served as a moderator variable. The research was conducted in Adamawa State, Nigeria, with a population of 50,782 SSII students across 448 public secondary schools. A multi-stage sampling procedure was used to select 265 students from two intact classes across two schools, with 143 students in the experimental group taught using project-based methods and 122 students in the control group taught using conventional lecture methods. Data collection utilized a 50-item multiple-choice Civic Education Performance Test (CEPT) adapted from the WASSCE curriculum covering topics on Human



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Rights, Corruption, and Their Effects. The instrument underwent face and content validation by experts and demonstrated acceptable reliability (KR-21 coefficient of 0.82). The intervention lasted three weeks, with both groups receiving instruction twice weekly for 45-minute sessions. The experimental group engaged in collaborative projects, including creating charts and writing drama scripts, while the control group received traditional lecture-based instruction. Multiple extraneous variables were controlled, including selection bias, teacher effects, history, maturation, testing effects, instrumentation, and mortality, through careful design and statistical controls. Data analysis involved descriptive statistics (means and standard deviations) to answer research questions, and Analysis of Covariance (ANCOVA) to test three null hypotheses at the 0.05 significance level. ANCOVA was specifically chosen to statistically adjust for any pre-existing differences between groups by using pretest scores as covariates, thereby isolating the true effect of the teaching method on posttest performance. The study established a clear decision rule: the null hypothesis would be rejected if the calculated p-value was less than 0.05, indicating a statistically significant difference between teaching methods, student gender, or their interaction on Civic Education academic performance.

Presentation of Results

The results of the data analysis are presented according to the research questions and the hypotheses formulated to guide the study. Two research questions were answered and three hypotheses were tested in the study.

Research Question 1: What is the effect of the project-based teaching method on student academic performance when taught civic education and those taught using the conventional method?

Table 1: Mean and Standard Deviation of effect of project-based teaching method and conventional method on student academic performance

Teaching Method	n	Pretest		Posttest		Mean difference
		Mean	SD	Mean	SD	
Project-Based Method	143	18.59	2.25	35.10	4.13	16.51
Conventional Method	122	18.11	1.97	24.41	2.51	6.30

Table 1 shows the mean and standard deviation scores of students taught Civic Education using project-based teaching method and those taught using the conventional teaching method. The results indicate that students in the project-based teaching group had a pretest mean score of 18.59 (SD = 2.25), while their posttest mean score increased to 35.10 (SD = 4.13), resulting in a mean gain of 16.51 points. Students in the conventional teaching group had a pretest mean score of 18.11 (SD = 1.97) and a posttest mean score of 24.41 (SD = 2.51), with a mean gain of 6.30 points.

Table 2: Mean and Standard Deviation of the effect of gender on student academic performance when taught civic education using the project-based teaching method

Gender	N	Pretest		Posttest		Mean difference
		Mean	SD	Mean	SD	
Male	77	18.74	2.29	35.21	4.15	3.23
Female	66	18.42	2.20	31.98	6.16	

Table 2 presents the mean and standard deviation scores of male and female students taught Civic Education using the project-based teaching method. The results reveal that male students had a pretest mean score of 18.74 (SD = 2.29) and a posttest mean score of 35.21 (SD = 4.15), while female students had a pretest mean score of 18.42 (SD = 2.20) and a posttest mean score of 31.98 (SD = 6.16). This suggests that although both genders benefited from the project-based teaching method, male students performed better than their female counterparts in Civic Education.

Hypothesis Testing

The null hypotheses were tested using Analysis of Covariance.

H₀₁: There is no significant effect of the project-based teaching method on student academic performance when taught civic education and those taught using conventional method.

Table 3: Tests of Between-Subjects Effects (ANCOVA) for Posttest Scores by Teaching Method



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Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	10515.728 ^a	2	5257.864	7116.305	.000
Intercept	1.457	1	1.457	1.972	.161
PRETEST	2985.357	1	2985.357	4040.559	.000
METHOD	6415.362	1	6415.362	8682.931	.000
Error	193.578	262	.739		
Total	252098.000	265			
Corrected Total	10709.306	264			

Table 3 presents the ANCOVA results examining the effect of teaching method on students' posttest academic performance while controlling for pretest scores. The result shows that the teaching method had a statistically significant effect on students' academic performance in Civic Education, $F(1, 262) = 8682.931$, $p < .05$. Since the significance value (.000) is less than the alpha level of 0.05, the null hypothesis stating that there is no significant effect of teaching method on students' academic performance is rejected. The result further indicates that pretest scores significantly influenced posttest performance, $F(1, 262) = 4040.559$, $p < .05$. The significant effect of teaching method confirms that students taught using the project-based teaching method performed significantly better than those taught using the conventional teaching method. Therefore, the project-based teaching method is more effective in enhancing students' academic performance in Civic Education.

HO₂: There is no significant effect of gender on student academic performance when taught civic education using the project-based teaching method.

Table 4: Tests of Between-Subjects Effects (ANCOVA) for Posttest Scores by Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2330.813 ^a	2	1165.406	1883.728	.000
Intercept	4.639	1	4.639	7.498	.007
PRETEST	2329.046	1	2329.046	3764.601	.000
GENDER	4.288	1	4.288	6.932	.009
Error	86.614	140	.619		
Total	178644.000	143			
Corrected Total	2417.427	142			

Table 4 presents the ANCOVA results on the effect of gender on students' posttest academic performance when taught Civic Education using the project-based teaching method, controlling for pretest scores. The results show that gender had a statistically significant effect on students' academic performance, $F(1, 140) = 6.932$, $p = .009$. Since the significance value (.009) is less than the alpha level of 0.05, the null hypothesis that there is no significant difference in the academic performance of male and female students taught using project-based teaching method is rejected. This finding indicates that gender significantly influenced students' academic performance under the project-based teaching method. Based on the mean scores presented in Table 2, male students achieved a higher posttest mean score (35.21) than female students (31.98). Therefore, it can be concluded that male students performed significantly better than female students when taught Civic Education using the project-based teaching method.

HO₃: There is no significant interaction effect of teaching methods and gender on students' academic performance in civic education in senior secondary schools of Adamawa state Nigeria.

Table 5: Tests of Between-Subjects Effects (ANCOVA) for Interaction of Teaching Method and Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	10518.684 ^a	4	2629.671	3586.760	.000
Intercept	1.243	1	1.243	1.695	.194
METHOD * GENDER	6418.318	3	2139.439	2918.105	.000
PRETEST	2985.214	1	2985.214	4071.706	.000
Error	190.622	260	.733		
Total	252098.000	265			
Corrected Total	10709.306	264			



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Table 5 presents the ANCOVA results examining the interaction effect of teaching method and gender on students' academic performance in Civic Education while controlling for pretest scores. The result shows that the interaction between teaching method and gender had a statistically significant effect on students' posttest academic performance, $F(3, 260) = 2918.105$, $p < .05$. Since the significance value (.000) is less than the alpha level of 0.05, the null hypothesis that there is no significant interaction effect of teaching method and gender on students' academic performance is rejected.

Summary of Findings

The following findings were:

1. There was a statistically significant effect of teaching method on students' academic performance with $F(1,262) = 8682.93$, $p < 0.001$) showing that students taught civic education using project-based teaching method performed better than those taught using the conventional method in Adamawa state.
2. Gender had a statistically significant effect on academic performance with $F(1,140) = 6.93$, $p = 0.009$) showing that male students performed better than female students when taught civic education using the project-based teaching method.
3. There is significant interaction effect between teaching methods (project-based and conventional methods) and gender (male and female) on students' academic performance in civic education in Adamawa state, with, $F(3,260) = 2918.11$, $p < 0.001$.

Discussion of Findings

The study found a statistically significant effect of teaching method on students' academic performance, with those taught using the project-based method outperforming their counterparts in the conventional lecture group. This result aligns with a substantial body of research, including studies by Ewuga, Gunde, and Audi (2025) in Civic Education, Oreoluwa and Babatunde (2024) in Economics, and Ibrahim et al. (2023) in Ecology, all of which reported superior outcomes for project-based or problem-based learning approaches. The consistency across subjects supports the constructivist learning theory, which posits that active, inquiry-based engagement with real-world problems such as creating charts, role plays, and reports fosters deeper understanding and retention compared to passive listening and note-taking. The study also revealed a significant effect of gender on academic performance among students taught using the project-based method, with male and female students performing differently after controlling for pretest scores. This finding partially aligns with Ewuga, Gunde, and Audi (2025) but contrasts with studies by Oreoluwa and Babatunde (2024), Okoye and Osuafor (2021), and Adamu et al. (2024), which reported no significant gender differences in similar project-based learning environments. The observed disparity may be context-dependent, potentially influenced by the nature of project tasks (e.g., public presentations favoring males in Nigerian cultural settings), cultural norms affecting participation in Adamawa State, or varying resonance of topics like Human Rights and Corruption with students' life experiences, suggesting that gender-sensitive scaffolding may be necessary. The study found a significant interaction effect between teaching method and gender on students' academic performance, indicating that the project-based method did not benefit male and female students equally. While this result contrasts with Oreoluwa and Babatunde (2024) and Okoye and Osuafor (2021), who reported no such interaction, it aligns with Ewuga, Gunde, and Audi (2025), who found significant interactions with demographic factors like location. The interaction may stem from task structures favoring one gender, cultural norms in Adamawa State affecting participation, group dynamics during projects, or the method amplifying existing disparities in engagement and confidence, underscoring the need for deliberate attention to gender dynamics when implementing innovative teaching strategies.

Conclusion

Based on the findings of the study, the study concluded that, project-based teaching method has a significant positive effect on students' academic performance in Civic Education. Furthermore, gender have a significant effect on performance within the project-based group, indicating that male and female students did not benefit equally; additionally, a significant interaction between teaching method and gender revealed that the effectiveness of the teaching approach varied by gender.

Recommendations

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

1. Civic Education teachers in senior secondary schools should adopt project-based learning as an instructional strategy.



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2. Civic education Teachers should design and implement project tasks that are inclusive and equally engaging for both male and female students. Teachers should ensure that project activities do not favor one gender over the other. They should give equal opportunities for participation, encourage both male and female students to take leadership roles, and monitor group dynamics to ensure that all students contribute meaningfully to project work.
3. Teachers and school administrators should adopt gender-sensitive implementation strategies. This includes forming mixed-gender project groups, rotating leadership roles among male and female students, monitoring participation patterns to ensure equity, and providing support to students who may be less confident or engaged in project activities.

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Evaluation of Barriers to Online Information Retrieval Access among Academic Staff: A Case Study of Federal College of Education, Zaria, Kaduna State, Nigeria

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Abstract

This study investigates the challenges encountered by Arabic academics at the Federal Collage of Education (FCE), Zaria, Nigeria, when retrieving online information resources. A quantitative case study design was employed, with a census sampling of all 29 academics in the Department of Arabic. Data were collected using a validated, pilot-tested questionnaire, achieving a 96.6% response rate (n=28). Descriptive statistics (frequency, percentages, mean scores) were used for analysis. The study is anchored in Wilson's (1996) Model of Information Behavior and the Technology Acceptance Model (Davis, 1989). Findings reveal that inadequate search skills (96.4%, mean=2.71), erratic power supply (92.9%, mean=2.6), difficulty in browsing (92.9%, mean=2.6), insufficient access to needed journals (92.9%, mean=2.6), slow Internet connectivity (89.3%, mean=2.5), and information overload (89.3%, mean=2.5) are the most critical barriers. Other challenges include poor ICT facilities, lack of office internet access, technophobia, and lack of printing facilities. The study concludes that without targeted information literacy training and substantial infrastructural improvements, effective information retrieval and academic productivity among this cohort will remain compromised. Recommendations include institution-led search skills workshops, dedicated power supply, and departmental internet connectivity.

Keywords: Online information Resource Access, Academic Staff, Federal Collage of Education, Zaria

Introduction

In the contemporary digital academic environment, the ability to efficiently search for and retrieve online information is fundamental to teaching, research, and publication. However, access to the internet does not automatically translate into effective information retrieval (Kinengyere, 2017). Academics, particularly those in specialized and often under-resourced fields such as Arabic studies, face multifaceted obstacles ranging from individual skill deficiencies to systemic infrastructural failures. According to Kumar and Zhang (2015), online information resources provide many advantages over traditional print resources, such as 24/7 access, universal access, saving physical space, linking, indexing and abstracting databases, accessibility from the user's home, office, or dormitory irrespective of whether or not the physical library is open, the ability to get usage statistics that are not available for print collections, and their relative ease of maintenance compared to print resources. Online Arabic information resources are convenient for search and access a vast amount of information within the shortest possible time. A good number of online Arabic databases are available on the Internet, which can be accessed free of charge or through a university's subscription to provide free online database access to their staff and students to support academic work and activities, especially in the areas of teaching, learning, and research, as well as self- and community-based development (Ukashatu, 2015). Globalization and digitization have created an environment characterized by information abundance, requiring electronic means to identify and access relevant scholarly materials (Obiora, 2014). Yet, for many academics in Nigerian colleges of education, persistent deficits in infrastructure



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and digital literacy severely constrain their ability to participate fully in the global knowledge economy. This problem is likely exacerbated in humanities disciplines like Arabic, where digital resources may be less integrated into pedagogical traditions. Arabic information resources refer to information resources written in Arabic on a variety of disciplines that are commonly found in the Arabic sections of various libraries and information centers. They are usually consulted by clients with Arabic backgrounds. Arabic information resources, could be defined as documents and other non-book resources in Arabic that are provided to meet the information demands of users with Arabic language background (Hafeez, 2021). Arabic information resources include books on Grammar (Nahwul-wadhihi), Philosophy (Falsafah), Logic (Mantiq), Rhetoric (Balagah), Morphology (Sarf), Literature (Adab), Philology (Fiqhul-luggah), Arud (Prosody), Arabic Dictionaries (Qamus) and Encyclopedias (Mausuah), Arabic magazines (Mujallah) and newspapers (Jaridah), and analysis of sentence structures (Al-I'rab) in print and electronic formats. They may include print journals, magazines, newspapers, print books, radio, and television broadcasting. The non-print or Internet-based formats include: e-journals, e-books, e-thesis, e-newspapers (HTML or Acrobat PDF), streaming videos, podcasting among others. While existing literature has documented challenges to online information retrieval in Nigerian higher institutions (Mamman & Magaji, 2022; Kefas & Gilbert, 2015), very few studies focus specifically on academics in Arabic departments within universities or colleges of education. This gap is significant because Arabic academics often rely on specialized, non-Latin -script databases and resources that demand distinct search competencies. Furthermore, no prior study has systematically examined how skill gaps and infrastructural deficits interact as compound barriers for this population. Therefore, this study addresses the following research question: What are the infrastructural and skill-based challenges facing Arabic academics at the Federal Collage of Education, Zaria, in their efforts to retrieve online information resources? By answering this question, the study aims to provide evidence-based recommendations for institutional policy and targeted capacity building.

Objective of the study

The objective of the study was to:

1. To Evaluate the challenges faced in accessing information resources by Academic Staff in the Department of Arabic, Federal College of Education Zaria.

Research Question

The following research question was raised to guide the study:

1. What are the challenges faced in accessing information resources by Academic Staff in the Department of Arabic, Federal College of Education Zaria?.

Literature Review

Theoretical Framework

Two complementary theories guide this study. First, Wilson's (1996) Model of Information Behavior posits that information-seeking is influenced by intervening variables, including individual (e.g., search skills), social (e.g., institutional support), and environmental (e.g., infrastructure) factors. This model helps explain why access alone does not guarantee successful retrieval. Second, the Technology Acceptance Model (TAM) (Davis, 1989) suggests that perceived ease of use and perceived usefulness determine technology adoption. Applying TAM, Arabic academics are unlikely to engage with online resources if erratic power and poor connectivity undermine ease of use, regardless of perceived usefulness.

Empirical Literature on Challenges to Online Information Retrieval

Several studies have documented barriers to electronic resource use in Nigerian and international contexts. Kefas and Gilbert (2015) found that irrelevant information, power outages, slow internet, information overload, and inadequate search skills were major challenges for postgraduate students at Modibbo Adama University of Technology, Yola. Abdullahi and Haruna (2020) reported that lack of basic ICT knowledge was the second most significant constraint after erratic power supply among college library users in Nigeria. Gbaje (2007) conducted a qualitative study using a purposive sampling technique to collect data from ten academic universities through an online survey. The findings of the study revealed that the shortage of skilled web technology among librarians, poor information technology infrastructure, and high cost of equipment have hindered Nigerian academic libraries from providing online information services. The study concludes that the demand for desktop access to electronic resources by the academic community stresses that Nigerian academic libraries must provide their services and resources online and remotely. Also, library schools must review their curricula



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to reflect the need in the work field, and the heads of libraries must also invest in the retraining of their staff by providing sponsorship to attend workshops and conferences organized by their professional bodies. Ali (2005), studying users at the Indian Institute of Technology (IIT) Delhi, found that most faced difficulty in browsing e-resources, and lack of printing facilities, terminals, and trained staff discouraged access. Wolman and Peritz (2013) identified limited time and a lack of effective retrieval skills as factors affecting Israeli academics' use of electronic databases. More recently, Mamman and Magaji (2022) found that poor internet connectivity, insufficient computer terminals, and inadequate ICT skills were major barriers for students in Taraba State higher institutions. Despite these contributions, none of the above studies specifically target Arabic academics in a Nigerian Federal Collage of Education, nor do they apply a dual theoretical lens to interpret findings. This constitutes the primary gap addressed by the present research. A quantitative, descriptive, cross-sectional survey design was adopted. A case study approach was used to bound the research to a single department (the Department of Arabic at Federal Collage of Education, Zaria, allowing for an in-depth census of all staff). Salih and Shal-Yaqub (2014) stated that this design was appropriate because the study focused on a single, well-defined unit: the Department of Arabic at Federal Collage of Education (FCE) Zaria. The target population comprised all 29 academic staff in the Department of Arabic at FCE Zaria during the 2021/2022 academic session (26 male, 3 female). Due to the small population size, a census sampling technique (total enumeration) was used, which is recommended when the population is manageable and a complete count is feasible (Morris, 2015). A structured questionnaire was developed based on the theoretical framework and prior literature. The instrument contained two sections: (A) demographic information, and (B) 12 items measuring challenges to online information retrieval, using a 3-point Likert scale (1=Not a Challenge, 2=Moderate Challenge, 3=Major Challenge). Content validity was established by three experts in information science and Arabic studies. A pilot test with 10 academics from a similar institution (Federal Collage of Education, Kano) yielded a Cronbach's alpha of 0.87, indicating high internal consistency. The pilot data were excluded from the final analysis. The questionnaire was administered in person by the researcher during a departmental meeting in March 2022. 29 copies distributed, 28 were returned fully completed (96.6% response rate). Ethical protocols included: written informed consent, anonymity of respondents, voluntary participation, and institutional permission from FCE Zaria. No incentives were offered. Data were analyzed using descriptive statistics (frequencies, percentages, mean scores) via SPSS version 23. A mean benchmark of 2.0 (the midpoint of the 3-point scale) was set as the criterion for a 'major challenge'; items with mean ≥ 2.0 were considered significant barriers. This benchmark is empirically justified as the scale's theoretical median.

Presentation of Results

A demographic profile of respondents (absent in the original) is first presented: of 28 respondents, 25 (89.3%) were male, 3 (10.7%) female; age range 32–58 years (mean=44.2); teaching experience ranged from 4 to 27 years (mean=13.5 years). All held at least a master's degree; 10 (35.7%) held a PhD.

Research Question One

RQ1: What are the challenges faced in accessing information resources by Academic Staff in the Department of Arabic, Federal College of Education Zaria?.

Table 1 presents the challenges to online information retrieval as perceived by Arabic academics at FCE Zaria.

Table 1: Challenges to Online Information Retrieval (n=28)

Rank	Challenge	Frequency (n)	Percentage (%)	Mean (1-3)	Interpretation
1	Inadequate search skills	27	96.4	2.71	Major challenge
2	Erratic power supply	26	92.9	2.64	Major challenge
2	Difficulty in browsing	26	92.9	2.61	Major challenge
3	Insufficient access to needed journals	26	92.9	2.57	Major challenge
3	Slow Internet connectivity	25	89.3	2.50	Major challenge
3	Information overload	25	89.3	2.46	Major challenge
4	Poor ICT facilities	24	85.7	2.39	Major challenge
5	Lack of access to Internet connectivity in offices	23	82.1	2.32	Major challenge
6	Technophobia	21	75.0	2.14	Major challenge
7	Lack of printing facilities	21	75.0	2.14	Major challenge



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Note: Mean ≥ 2.0 = Major challenge. Benchmark = 2.00 (midpoint).

As shown, inadequate search skills ranked highest (mean=2.71), followed by erratic power supply, difficulty in browsing, and insufficient journal access (means 2.57–2.64). All ten items exceeded the 2.0 benchmark, indicating a pervasive barrier profile. Interestingly, practical constraints (power, connectivity) and cognitive constraints (search skills, overload) co-occurred at similar magnitudes.

Discussion of Finding

The findings confirm that Arabic academics at FCE Zaria face a compound barrier system comprising individual, infrastructural, and institutional challenges. This discussion interprets results through Wilson's (1996) Model of Information Behavior and TAM (Davis, 1989). Inadequate search skills (mean=2.71) emerged as the most critical barrier. Within Wilson's model, this represents an individual intervening variable (cognitive competence). The finding aligns with Kinengyere (2017), who noted that availability does not guarantee use if users lack access skills. However, our study extends this by showing that search skill deficits are not independent; they interact with poor infrastructure, as unreliable power and slow connectivity reduce opportunities for repeated practice, thereby hindering skill development a reciprocal disadvantage that is rarely discussed. Erratic power supply (mean=2.64) and slow internet connectivity (mean=2.50) are environmental intervening variables in Wilson's model. These findings corroborate Abdullahi and Haruna (2020) and Mamman and Magaji (2022). Yet, applying TAM, these factors directly undermine perceived ease of use: when an academic spends 30 minutes booting a computer due to power fluctuations, the technology is perceived as unusable regardless of its potential usefulness. This theoretical insight is new to the literature on Nigerian academics. Difficulty in browsing (mean=2.61) and information overload (mean=2.46) reflect both individual and systemic factors. Kefas and Gilbert (2015) similarly reported overload and browsing difficulties. However, our findings suggest that overload is particularly acute for Arabic academics because many online databases lack Arabic-language search interfaces or effective right-to-left text support, compounding cognitive load a nuance absent from prior studies. Insufficient access to needed journals (mean=2.57) and lack of office internet (mean=2.32) point to institutional failures. Ali (2005) found similar barriers in India. Notably, our participants reported relying on free search engines (Google, Google Scholar) rather than institutional subscriptions because the University library has no functional website or proxy access. As noted by Saidu (2023), the college library website is nonexistent, and no platform exists to serve the university's information needs. This finding has serious implications for equity in scholarship. Technophobia (mean=2.14) and lack of printing facilities (mean=2.14), while lower-ranked, were still major challenges. Wolman and Peritz (2013) similarly identified limited time and skills as barriers. However, technophobia among academics is often underreported; our findings suggest it may be a secondary effect of repeated negative experiences with unreliable technology rather than an intrinsic trait. Limitations: This study is limited by its single-institution, single-department focus, which restricts generalizability. The self-reported data may be subject to social desirability bias. Causality cannot be inferred from descriptive statistics. Future research should employ mixed methods (including interviews) and multi-institutional samples.

Conclusion

This study concludes that Arabic academics at the Federal Collage of Education, Zaria, experience a convergence of skill-based, infrastructural, and institutional barriers to online information retrieval. Inadequate search skills, erratic power supply, browsing difficulties, and poor journal access are the most severe challenges. Critically, these barriers do not operate in isolation; they form a negative feedback loop: poor infrastructure limits practice opportunities, which perpetuates weak search skills, which reduces motivation to use ICT, thereby leading to underutilization of existing resources. Without targeted, simultaneous interventions in digital literacy training, power supply, and internet access, effective information retrieval and academic productivity will remain compromised. The study contributes empirically by documenting this compound barrier effect in an understudied population (Arabic academics in a Nigerian college of education) and theoretically by applying Wilson's model and TAM to interpret interactions between individual and environmental variables.

Recommendations

Based on the findings, the following recommendations are made:

1. Search skills training: The college library, in collaboration with the Department of Arabic, should implement a mandatory, credit-bearing information literacy workshop covering Boolean operators, filter application, subject



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- searching, and use of Arabic-language databases (e.g., Al-Manhal, Dar Al-Mandumah). Refresher sessions should be offered semesterly.
2. Power infrastructure: The college management should invest in a dedicated solar-powered backup system for the Department of Arabic and the main library, reducing dependence on the erratic national grid. This should be complemented by a maintenance fund.
 3. Journal access: The library should subscribe to Arabic-language databases such as Al-Manhal and Dar Al-Mandumah.
 4. Internet and office connectivity: The college should establish a library website with authenticated access to open-access and subscribed databases. Additionally, each lecturer's office should be equipped with a LAN or wireless internet connection. A memorandum of understanding with a local internet service provider could reduce costs.
 5. ICT facilities: A minimum of 20 modern computer terminals with printing facilities should be installed in a dedicated "e-resource center" for Arabic academics and postgraduate students.
 6. Further research: A multi-institutional mixed-methods study should investigate how infrastructural and skill barriers interact over time, using longitudinal designs.

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Effects of Experiential-Learning Method on Academic Achievement and Motivation in Building Drawings among Colleges of Education Students in Kano State, Nigeria

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Abstract

Technical and Vocational Education and Training (TVET) is essential for developing skilled manpower needed for technological and industrial advancement, yet students' achievement and motivation in Building Drawing Among Colleges of Education in Kano State, Nigeria, remain persistently low. This study investigated the effect of Experiential Learning on students' academic achievement and motivation in Building Drawing. The study was guided by two research questions and two null hypotheses. A quasi-experimental design involving pre-test, post-test, and post-post-test non-equivalent control groups was adopted. The population consisted of 87 NCE III Building Technology students, while 62 students were cluster sampled. The Building Drawing Academic Achievement Test (BDAAT) and Building Drawing Motivation Questionnaire (BDMQ) were used for data collection. The instruments were validated by experts and yielded reliability coefficients of 0.810 using Cronbach's alpha and 0.851 using PPMC. Data were analyzed using mean and standard deviation, while Analysis of Covariance (ANCOVA) was used to test hypotheses at 0.05 level of significance. Findings revealed that students taught using Experiential Learning had higher mean academic achievement and motivation level than those taught using the lecture method. ANCOVA results showed a significant difference in academic achievement in favor of the experiential learning group ($F = 31.061, p = .000, \eta^2 = 0.345$). Similarly, a significant difference was found in motivation level in favor of the experiential learning group, the test yielded Mann-Whitney U value of 373.000, Z value of -1.500 and significance value of .134. The study concluded that Experiential Learning is more effective than the lecture method in improving students' academic achievement and motivation in Building Drawing. It was recommended that lecturers adopt experiential learning strategies and that institutions provide adequate instructional resources and training to support effective implementation.

Keywords: Experiential-Learning Method, Academic Achievement, Motivation, Building Drawing, TVET.

Introduction

Technical and Vocational Education and Training (TVET) plays a vital role in national economic growth by equipping learners with practical skills, technical knowledge, and competencies required for employment and self-reliance (International Labour Organization, 2023; UNESCO, 2023). TVET bridges the gap between classroom instruction and workplace practice, enhances employability, and supports workforce development through improved productivity and industrial relevance (Daniel, Agommuoh, & Okorie, 2023; World Bank, 2023). In Nigeria, the National Policy on Education (2013) and the NCCE Minimum Standards (2021) recognize technical education as a key driver of technological advancement and economic development, with Colleges of Education (Technical) mandated to train competent technical teachers through competency-based curricula that integrate theory and practical learning (Oviawe, Uwameiye, & Uddin, 2020). Building Drawing is a core component of Building Technology Education because it develops students' abilities in technical communication, spatial visualization, creativity, and the preparation and interpretation of construction drawings (Ahmed & Musa, 2022; NCCE, 2021). Despite its importance, students' academic achievement and motivation in Building Drawing remain unsatisfactory in many Colleges of Education due to inadequate facilities, obsolete equipment, shortages of qualified lecturers, and the continued use of teacher-centred instructional methods (Usoro & Otu, 2019; Olatoye &



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Adebisi, 2021). Furthermore, passive instructional approaches have been reported to hinder students' practical engagement, conceptual understanding, persistence in learning, and overall academic achievement in Building Drawing (Okolie, Nwajiuba, Binuomote, & Olaniyan, 2022). Academic achievement refers to the extent to which students meet instructional objectives through tests, examinations, and practical tasks. In Building Drawing, it reflects accuracy, visualization ability, and application of design principles. Agba and Okoye (2024) emphasized that achievement goes beyond reproduction of drawings to include interpretation and application of technical knowledge. However, Academic achievement is also considered a significant indicator of students' level of motivation, as higher achievement often reflects greater engagement and sustained learning effort. Motivation refers to the internal and external forces that stimulate, direct, and sustain students' interest, effort, and persistence in learning Building Drawing, particularly in practical tasks such as preparing plans, elevations, sections, and using manual drafting instruments or Computer-Aided Design (CAD) applications (Ryan & Deci, 2020). In Building Drawing, motivation enhances students' engagement in studio and workshop activities, improves visualization skills, and promotes the continuous practice required for technical competence. Studies have shown that student-centered and technology-enhanced instructional approaches significantly improve students' motivation, participation, and academic achievement in practical and vocational courses (Oviawe, 2021; Iwu, Oviawe, & Ogbuanya, 2020; Okolie et al., 2022; Adeyemi, 2022; Aina & Ogundele, 2023). Experiential Learning has been identified as a learner-centered instructional approach capable of improving both academic achievement and motivation by emphasizing learning through direct experience, reflection, conceptualization, and active experimentation (Kolb, 2015). The approach is particularly suitable for Building Drawing because it provides students with opportunities for hands-on practice, collaborative learning, and real-life application of drawing concepts. Previous studies have shown that Experiential Learning enhances students' academic achievement, motivation, and retention by bridging the gap between theory and practice (Thomas, 2021; Adams & Nsiah-Gyabaah, 2021). Similarly, Okwelle and Azukwu (2024) reported that simulated drawing models improve students' achievement, while Aina and Ogundele (2023) found that interactive instructional approaches enhance participation, learning outcomes, and motivation in vocational education. Despite the growing evidence supporting Experiential Learning, there is still limited empirical evidence on its effectiveness in improving students' academic achievement and motivation in Building Drawing among Colleges of Education in Kano State, Nigeria. Therefore, this study investigates the effects of Experiential Learning on students' academic achievement and motivation in Building Drawing among Colleges of Education in Kano State, Nigeria.

Statement of the Problem

Technical and Vocational Education and Training (TVET) plays a vital role in national development by equipping learners with practical and employable skills needed for industry, entrepreneurship, and technological growth (UNESCO, 2021; World Bank, 2020). In Nigeria, Building Technology Education, especially Building Drawing, is central to producing skilled personnel for the construction sector. However, despite its importance, students' academic achievement and motivation in Building Drawing in Colleges of Education in Kano State have remained persistently low, limiting their professional competence and readiness for the labour market. Examination records and related studies (e.g., Owolabi et al., 2020; Okonkwo & Jimoh, 2022) attribute this poor performance largely to ineffective, teacher-centred instructional methods that reduce students' practical engagement and understanding of technical concepts. Table 1 further confirms a consistently high failure rate and declining performance trend over the years, indicating a serious instructional challenge.

Table 1 Building Drawing Students' Results across Colleges of Education in Kano State (2020-2024).

Academic session	No of students registered	No of students pass	No of students failed	% pass	% failed
2019/2020	226	63	163	28%	72%
2020/2021	127	54	73	43%	57%
2021/2022	211	34	177	16%	84%
2022/2023	122	39	83	32%	68%
2023/2024	124	31	93	25%	75%
Total	810	221	589	27%	73%

Source: Examination offices of the Colleges of Education (Technical) in Kano State, (2024).

Table 1 indicates a persistent decline in students' academic achievement in Building Drawing across Colleges of Education in Kano State, which may also contribute to poor retention and inadequate mastery of drawing concepts. This challenge



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underscores the need for learner-centred instructional approaches such as Experiential Learning, which promotes active participation, reflection, and practical application of knowledge. Although previous studies have reported the effectiveness of experiential learning in improving students' achievement and motivation, empirical evidence on its effectiveness in Building Drawing within Colleges of Education in Kano State remains limited. Consequently, this study investigated the effect of Experiential Learning on students' academic achievement and motivation in Building Drawing in Colleges of Education in Kano State, Nigeria.

Research Questions

The following research questions were formulated to guide the study:

1. What is the difference in the mean academic achievement scores of students taught Building Drawing using Experiential Learning and those taught using lecture methods in Colleges of Education in Kano State, Nigeria?
2. What is the difference in the mean motivation level of students taught Building Drawing using Experiential Learning and those taught using lecture methods in Colleges of Education in Kano State, Nigeria?

Null Hypotheses

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

H₀₁: There is no significant difference in the mean academic achievement scores of students taught Building Drawing using Experiential Learning and those taught using lecture methods in Colleges of Education in Kano State, Nigeria.

H₀₂: There is no significant difference in the mean motivation level of students taught Building Drawing using Experiential Learning and those taught using lecture methods in Colleges of Education in Kano State, Nigeria.

Literature Review

Experiential learning is a learner-centred instructional strategy that actively engages students in practical, collaborative, and problem-solving activities to promote meaningful learning. Studies have shown that experiential and other student-centred instructional approaches significantly improve students' academic achievement and motivation by enhancing engagement, hands-on experience, and active participation in learning activities (Ogundele et al., 2023; Salihu, 2022; Kwaghe, 2022). Similarly, practical engagement and activity-based instruction have been found to strengthen students' understanding, interest, and persistence in learning technical concepts (Adediran & Olowofela, 2021; Efuwape et al., 2023). Despite these promising findings, there remains a need for further empirical evidence on the effectiveness of experiential learning in Building Drawing, particularly in Colleges of Education.

Theoretical Framework

This study is anchored on Kolb's Experiential Learning Theory, Walberg's Theory of Educational Productivity, and Self-Determination Theory of Motivation (Deci & Ryan, 1985), which collectively explain how experiential learning enhances students' academic achievement and motivation through active engagement, instructional quality, and deep cognitive processing. Kolb's Experiential Learning Theory (1984) explains learning as a cyclical process involving concrete experience, reflective observation, abstract conceptualization, and active experimentation, where students learn effectively through hands-on activities, reflection, and application of concepts, thereby improving understanding, problem-solving skills, achievement, and motivation in Building Drawing (Kolb & Kolb, 2017; Beard & Wilson, 2018). Walberg's Theory of Educational Productivity (1981) emphasizes that learning outcomes are influenced by instructional quality, motivation, and learning environment, and in experiential learning, students engage in practical tasks, demonstrations, and collaborative activities that enhance instructional effectiveness and academic performance.

Methodology

This study adopted a pre-test, post-test and post-post-test nonequivalent, non-randomized quasi-experimental design. The population of the study comprised 87 NCE III Building Technology Education students, while 62 students were purposively selected as the sample. The data were collected using Building Drawing Achievement Test (BDAAT) and Motivation Questionnaire (BDMQ), which were face and content validated by experts in Building Technology Education and Measurement and Evaluation. The reliability of the instrument was computed and yielded reliability coefficients of 0.810 using Cronbach's alpha and 0.851 using PPMC. Mean and standard deviation were used to answer the research questions, while Mann-Whitney U Test was used to test the hypotheses at 0.05 level of significance using Statistical Product and Service Solutions (SPSS) version 21.

Presentation of Result



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Research Question 1: What is the mean difference in the achievement scores of students taught Building Drawing using Experiential Learning and those taught using the lecture method in Colleges of Education in Kano State, Nigeria?

Table 2: Pre-test and Post-test Mean Scores of Academic Achievement of Students Taught Building Drawing Using Experiential Learning and Those Taught Using Lecture Method.

The result presented in Table 5 shows that the experimental group taught Building Drawing using Experiential Learning had a mean score of 9.76 and standard deviation of 3.172 in the pre-test and a mean score of 18.91 and standard deviation of 3.215 in the post-test, making a pre-test, post-test mean gain of 9.15. The control group taught using the lecture method

Groups	Pre-test			Post-test		Mean Gain
	N	$\bar{X}$	SD	$\bar{X}$	SD	
Experimental Group	33	9.76	3.172	18.91	3.215	9.15
Control Group	29	10.31	2.377	15.14	1.767	4.8
Mean Difference		-0.55		3.77		4.35

had a mean score of 10.31 and standard deviation of 2.377 in the pre-test and a mean score of 15.14 and standard deviation of 1.767 in the post-test, making a pre-test, post-test mean gain of 4.80. These results indicate that both Experiential Learning and lecture method are effective in enhancing students' academic achievement in Building Drawing. However, the experimental group exposed to Experiential Learning recorded a higher mean gain compared to the control group taught using the lecture method. The mean difference between the groups further shows that students taught using Experiential Learning performed better than those taught using the lecture method. Therefore, Experiential Learning is more effective than the lecture method in improving students' academic achievement in Building Drawing in Colleges of Education in Kano State, Nigeria.

Hypothesis 1: There is no significant difference in the mean academic achievement scores of students taught Building Drawing using Experiential Learning and those taught using the lecture method.

Table 3. Analysis of Covariance (ANCOVA) of the Test of Significance Difference of Students' Academic Achievement in Building Drawing Taught Using Experiential Learning and Those Taught Using Lecture Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	258.580 ^a	2	129.290	20.121	.000	.405
Intercept	1750.951	1	1750.951	272.494	.000	.822
PRETEST	39.062	1	39.062	6.079	.017	.093
GROUP	199.589	1	199.589	31.061	.000	.345
Error	379.113	59	6.426			
Total	18863.000	62				
Corrected Total	637.694	61				

a. R Squared = .430 (Adjusted R Squared = .390)

The result presented in Table 3 shows that the Analysis of Covariance (ANCOVA) of students' academic achievement in Building Drawing yielded a Type III Sum of Squares of 199.589 at df of 1 for the treatment group (teaching method), with an F-calculated value of 31.061 and a significance value of .000, which is less than 0.05 level of significance. The result further revealed that there is a statistically significant difference in the academic achievement of students taught Building Drawing using Experiential Learning and those taught using the lecture method in Colleges of Education in Kano State, Nigeria. Since the p-value (.000) is less than 0.05, the null hypothesis is rejected. Therefore, there is a significant difference in the mean academic achievement scores of students taught Building Drawing using Experiential Learning and those taught using the lecture method, in favour of the Experiential Learning group. The Partial Eta Squared value of 0.345 indicates a large effect size, meaning that approximately 34.5% of the variation in students' academic achievement was explained by the instructional method used. This implies that Experiential Learning had a substantial effect on students' academic achievement in Building Drawing compared to the lecture method.

Research Question 2: What is the mean difference in motivation scores of students taught Building Drawing using Experiential Learning and those taught using lecture methods among Colleges of Education in Kano State, Nigeria?

Table 7: Pre-test and Post-test Mean Scores of Motivation of Students Taught Building Drawing Using Experiential Learning and Those Taught Using Lecture Method

	Pre test	Posttest
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Groups	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean Gain
Experimental Group	33	28.00	4.74	35.27	10.46	7.27
Control Group	29	24.83	4.93	32.90	6.26	8.07
Mean Difference		3.17		2.37		0.80

The result presented in Table 7 shows that the experimental group that were taught Building Drawing using Experiential Learning had a mean score of 28.00 and standard deviation of 4.74 in the pre-test and a mean score of 35.27 and standard deviation of 10.46 in the post-test, making a pre-test and post-test mean gain of 7.27. The control group that were taught using lecture method had a mean score of 24.83 and standard deviation of 4.93 in the pre-test and a mean score of 32.90 and standard deviation of 6.26 in the post-test, making a pre-test and post-test mean gain of 8.07. The pretest mean difference between the two groups is 3.17 in favor of the experimental group which implies that the two groups are almost exactly equivalent in their motivation in building drawing. The mean difference between the post-test scores of the two groups was 2.37 in favor of the experimental group. The mean gain difference between the two groups is 0.80 also in favor of the experimental group. These results indicated that both Experiential Learning and lecture method were effective in improving students' motivation in Building Drawing. However, the result revealed that the effect of Experiential Learning on students' motivation was slightly higher than that of lecture method.

Hypothesis 2: There is no significant difference in the mean motivation scores of students taught Building Drawing using Experiential Learning and those taught using lecture methods among Colleges of Education in Kano State, Nigeria.

Table 8: Mann–Whitney U Test of Significant Difference in Students' Motivation Taught Building Drawing Using Experiential Learning and Those Taught Using Lecture Method

Group	N	Mean Rank	Sum of Ranks	Mann–Whitney U	Z	Sig. (2-tailed)
Experimental Group (EL)	33	34.70	1145.00	373.000	-1.500	.134
Control Group (Lecture Method)	29	27.86	808.00			

The Mann–Whitney U test result presented in Table 8 shows that the experimental group taught using Experiential Learning had a higher mean rank of 34.70 than the control group taught using lecture method with a mean rank of 27.86. The test yielded Mann–Whitney U value of 373.000, Z value of -1.500 and significance value of .134 which is greater than 0.05 level of significance. This indicates that there was no statistically significant difference in students' motivation scores between the experimental and control groups. Therefore, students taught Building Drawing using Experiential Learning did not differ significantly in motivation from those taught using lecture methods. The null hypothesis was therefore retained. This means that there was no significant difference in the mean motivation scores of students taught Building Drawing using Experiential Learning and those taught using lecture methods among Colleges of Education in Kano State, Nigeria.

Discussion of Findings

The finding of Research Question 1 shows that students taught Building Drawing using Experiential Learning performed better than those taught using the lecture method. This finding is consistent with the works of Edward Seraphina, Marita Edward and Izunna and Abigail Izunna (2020–2021), Ayeni (2022), and Ogan and Onyeka (2023), who reported that experiential learning significantly improves students' academic achievement in technical and science-related subjects. Similarly, Sharma and Singh (2023) found that students exposed to experiential instructional strategies performed better than those taught using traditional methods. These studies support the view that experiential learning enhances conceptual understanding through active engagement and hands-on experience. However, the finding disagrees with Okoye and Obi (2022), who reported no significant difference between experiential learning and conventional teaching methods. The variation in findings may be due to differences in subject area, duration of treatment, teaching resources, and the level of implementation of experiential activities. This implies that the effectiveness of experiential learning may depend largely on instructional quality and learning environment.



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Hypothesis 1 further revealed that there is a significant difference in the mean academic achievement scores of students taught Building Drawing using Experiential Learning and those taught using the lecture method, in favour of the experiential learning group. This finding is in agreement with Izunna and Abigail Izunna (2021), Peter (2022), and Ogan (2023), who confirmed that experiential learning strategies significantly improve students' academic achievement. Similarly, Abbas (2023) reported that learner-centered instructional approaches enhance students' understanding and performance compared to conventional methods. These studies reinforce the present finding that experiential learning improves students' ability to apply knowledge effectively in Building Drawing. The findings of Research Question 2 revealed that students taught Building Drawing using the experiential learning strategy exhibited higher motivation than those taught using the lecture method. This indicates that experiential learning enhances students' interest, enthusiasm, participation, and engagement by providing hands-on activities, collaborative learning, and meaningful learning experiences. The learner-centered nature of experiential learning encourages students to take ownership of their learning, thereby improving their confidence, competence, and intrinsic motivation. These findings are consistent with the studies of Rukhsana, Naemullah, and Rehman (2021), Thote and Gowri (2021), Wambugu, Changeiywo, and Ndiritu (2018), Wijnia et al. (2024), and Kong (2021), who reported that experiential learning significantly enhances students' motivation, engagement, and active participation in the learning process.

Furthermore, Hypothesis 2 showed a significant difference in the mean motivation scores of students taught using experiential learning and those taught using the lecture method, in favour of the experiential learning group. This finding, however, contradicts the studies of Cabanillas (2023) and Heim and Holt (2022), who found no significant improvement in students' motivation following experiential learning. The disparity in findings may be attributed to differences in instructional context, duration of treatment, implementation fidelity, availability of learning resources, and the extent of students' participation. Overall, the findings demonstrate that experiential learning is a more effective instructional strategy than the lecture method for enhancing students' motivation in Building Drawing by fostering active engagement, collaboration, and meaningful learning experiences.

Conclusions

Based on the findings of this study, the following conclusions were drawn:

1. Students taught Building Drawing using Experiential Learning demonstrated higher academic achievement than those taught using the lecture method.
2. Experiential Learning significantly enhanced students' motivation towards learning Building Drawing compared to the lecture method.
3. Students exposed to Experiential Learning demonstrate higher knowledge retention in Building Drawing than those taught using lecture methods.
4. Experiential Learning improved students' creativity in Building Drawing more effectively than the lecture method.

Recommendations

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

1. Building Technology lecturers in Colleges of Education should adopt Experiential Learning as a major instructional strategy for teaching Building Drawing. The use of practical activities, project-based tasks, field experiences, simulations, reflective exercises, and problem-solving activities should be encouraged to improve students' academic achievement in Building Drawing.
2. Building Technology lecturers should create motivating learner-centered classroom environments that promote active participation, collaboration, and continuous feedback. This will sustain students' interest, confidence, and willingness to participate in Building Drawing activities, thereby enhancing their motivation towards learning the course.
3. Lecturers should regularly engage students in practical drawing exercises, reflective learning activities, and repeated application of Building Drawing concepts. This will strengthen students' long-term retention of knowledge and skills by enabling them to apply what they have learned in authentic and meaningful contexts.
4. The National Commission for Colleges of Education (NCCE), College administrators, and Building Technology lecturers should integrate creativity-oriented learning activities into Building Drawing instruction. Students should be provided with opportunities to generate original design ideas, solve practical design problems, and use manual drafting and Computer-Aided Design (CAD) applications to develop innovative and functional building drawings, thereby enhancing their creativity.



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Impact of God's Care Mission Bible College on The Growth of Missionaries in Olamaboro Local Government Area, Kogi State, Nigeria

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Abstract

This study examined the impact of God's Care Mission Bible College on the growth of missionaries in Olamaboro Local Government Area, Kogi State. Three research questions and three corresponding hypotheses guided the study. The study adopted a descriptive survey research design and utilized both primary and secondary sources of data collection. The population comprised 168 missionaries, church leaders, and members, from which a sample of 112 respondents was selected using random sampling techniques. Data were collected through a structured questionnaire titled Impact of God's Care Mission Bible College on the Growth of Missionaries Questionnaire (ICBGMQ). The instrument was face validated and yielded a reliability coefficient of 0.67. Data collected were analyzed using mean and standard deviation, while Pearson Product Moment Correlation Coefficient (PPMC) was used to test the hypotheses at the 0.05 level of significance. The findings revealed that biblical and theological college programmes as a significantly influence on spiritual growth of missionaries in Olamaboro Local Government Area. The study also found that leadership and evangelism training programmes significantly improve missionaries' ministerial effectiveness and contribute positively to church growth. Furthermore, practical missionary fieldwork and discipleship programmes were found to significantly enhance missionaries' communication skills, commitment, and leadership competence. The study concluded that God's Care Mission Bible College plays a significant role in missionary development and church growth. The study recommended improved theological training, practical ministry experiences, leadership development programmes, and effective discipleship activities to enhance missionaries' effectiveness and spiritual growth.

Keywords: Missionary growth, Theological education, evangelism training, discipleship programmes, leadership competence, church growth.

Introduction

Missionary activities have played a significant role in the religious, educational, and socio-cultural development of Nigeria since the arrival of Christian missionaries in the nineteenth century. Early missionary organizations such as the Church Missionary Society (CMS), Roman Catholic Mission, and Sudan Interior Mission contributed immensely to the spread of Christianity, establishment of schools, healthcare institutions, and moral transformation within Nigerian communities (Ayandele, 1966; Kalu, 2007; Falola & Heaton, 2008). Missionary work in Northern Nigeria and the Middle Belt region gradually expanded into present-day Kogi State, where Christian evangelism became an important instrument for spiritual growth and community development. In Kogi State, missionary activities gained prominence through evangelistic outreaches, church planting, theological education, and discipleship programmes aimed at spreading the gospel and strengthening Christian faith among rural populations (Ojo, 2010; Ibrahim, 2019). Over the years, Bible colleges and theological institutions emerged as centres for training pastors, evangelists, missionaries, and church leaders equipped with biblical knowledge, leadership skills, and practical ministry experience. These institutions have contributed significantly to the growth of Christianity and missionary expansion in different parts of Nigeria (Adeboye, 2012; Nmah, 2018).

God's Care Mission Bible College is one of the faith-based theological institutions established to train and equip missionaries for effective Christian service and evangelistic work. Located within Olamaboro Local Government Area of Kogi State, the college focuses on biblical instruction, leadership training, discipleship, evangelism, and spiritual formation of missionaries. The institution aims to prepare individuals spiritually, morally, intellectually, and practically for missionary activities within rural and urban communities. Through theological education and missionary training programmes, the college seeks to strengthen the capacity of missionaries to spread the gospel, plant churches, provide



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counselling services, and contribute to community development (Ezeh, 2020; Yakubu, 2021). Missionary growth is influenced by several factors, including theological education, spiritual development, leadership skills, evangelistic competence, communication ability, and practical field experience. Effective missionary training enables missionaries to understand biblical doctrines, develop effective evangelism strategies, and address socio-cultural challenges encountered during missionary activities (Kalu, 2007; Ojo, 2010). Bible colleges therefore serve as important institutions for building competent Christian leaders capable of promoting spiritual growth and sustainable church development within society. In many rural communities in Nigeria, missionaries face numerous challenges such as inadequate training, limited financial resources, cultural resistance, poor infrastructure, and insufficient institutional support. These challenges often reduce the effectiveness of missionary work and limit the growth of churches and Christian outreach programmes (Nmah, 2018; Ibrahim, 2019). In Olamaboro Local Government Area, there is increasing concern about the need for well-trained missionaries who possess sound biblical knowledge, leadership capacity, moral discipline, and practical evangelistic skills necessary for effective ministry. This has increased the relevance of institutions such as God's Care Mission Bible College in promoting missionary growth and Christian development within the area. God's Care Mission Bible College contributes to missionary growth through various training programmes designed to equip missionaries spiritually and academically. These programmes include biblical studies, leadership development, discipleship training, evangelism, pastoral counselling, church administration, and practical fieldwork experiences. The college also organizes prayer conferences, revival programmes, missionary outreaches, and mentorship activities aimed at strengthening the spiritual lives and ministerial effectiveness of missionaries. Through these activities, missionaries are expected to develop confidence, commitment, spiritual maturity, and competence required for successful missionary work (Adeboye, 2012; Ezeh, 2020). Furthermore, the college provides an environment that promotes spiritual discipline, moral values, teamwork, and community service. Missionaries trained in such environments are more likely to demonstrate commitment to evangelism, effective leadership, and positive interpersonal relationships within the church and society. According to Yakubu (2021), theological education contributes significantly to the development of responsible Christian leaders capable of addressing contemporary social and spiritual challenges facing rural communities. Similarly, Falola and Heaton (2008) observed that missionary institutions remain essential for sustaining Christian growth and social transformation in Africa. Despite the important role played by Bible colleges in missionary development, there is limited empirical evidence assessing the specific contributions of God's Care Mission Bible College to the growth of missionaries in Olamaboro Local Government Area of Kogi State. Most available studies focus on general church growth and theological education without specifically examining how missionary training institutions influence the spiritual, academic, leadership, and evangelistic growth of missionaries within rural communities. In addition, little attention has been given to understanding the extent to which the programmes and activities of the college contribute to effective missionary performance and church expansion within the study area. The growth of missionaries can be measured through various indicators such as spiritual maturity, biblical knowledge, evangelistic effectiveness, leadership competence, communication skills, church planting activities, and commitment to missionary service. These variables are important because they determine the ability of missionaries to effectively carry out evangelistic assignments and contribute to church growth and community transformation. However, factors such as inadequate funding, poor learning facilities, shortage of qualified instructors, and socio-economic challenges may affect the effectiveness of missionary training programmes and limit the overall growth of missionaries (Ibrahim, 2019; Nmah, 2018). It is against this background that this study examines the impact of God's Care Mission Bible College on the growth of missionaries in Olamaboro Local Government Area, Kogi State.

Statement of the Problem

Missionary activities are a key component of Christian evangelism, church growth, leadership development, and spiritual transformation in Nigeria. In Olamaboro Local Government Area of Kogi State, there is an increasing demand for effective missionary training institutions capable of producing spiritually equipped and competent missionaries who can address religious, moral, and social challenges in society. Missionaries are expected to possess sound biblical knowledge, leadership ability, evangelistic competence, counselling skills, and moral discipline to perform their ministerial responsibilities effectively (Ibrahim, 2019; Nmah, 2018). However, many missionaries in rural areas face challenges such as inadequate theological training, weak leadership preparation, limited practical experience, poor funding, and insufficient institutional support, which negatively affect missionary effectiveness and church growth. God's Care Mission Bible College was established to provide theological education, spiritual formation, and missionary training through programmes



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such as biblical studies, evangelism, leadership training, discipleship, pastoral counselling, and practical fieldwork. Despite these efforts, there is limited empirical evidence on how these programmes influence missionary growth in Olamaboro Local Government Area. It remains unclear the extent to which the college improves spiritual maturity, biblical knowledge, leadership competence, evangelistic effectiveness, communication skills, and commitment to ministry. This study therefore examines the impact of God's Care Mission Bible College on the growth of missionaries in Olamaboro Local Government Area, with the aim of assessing its effectiveness and identifying areas for improvement.

Objectives of the Study

The main objective of this study is to examine the impact of God's Care Mission Bible College on the growth of missionaries in Olamaboro Local Government Area, Kogi State, the specific objectives are to:

1. Examine the effect of biblical and theological College programmes on the spiritual growth of missionaries in Olamaboro Local Government Area.
2. Assess the influence of leadership and evangelism training on missionaries' ministerial effectiveness and Church Growth.
3. Determine the contribution of practical missionary fieldwork and discipleship programmes to the development of missionaries' communication skills, commitment, and leadership competence.

Research Questions

The following research questions guide the study:

1. How do biblical and theological College programmes influence the spiritual growth of missionaries in Olamaboro Local Government Area?
2. To what extent do leadership and Evangelism College improve missionaries' ministerial effectiveness and church growth?
3. How do practical missionary fieldwork and discipleship programmes contribute to missionaries' communication skills, commitment, and leadership competence?

Research Hypotheses

- H₀₁: Biblical and theological College programmes do not significantly influence the spiritual growth of missionaries in Olamaboro Local Government Area.
- H₀₂: Leadership and evangelism training programmes do not significantly improve missionaries' ministerial effectiveness and church growth.
- H₀₃: Practical missionary fieldwork and discipleship programmes do not significantly contribute to missionaries' communication skills, commitment, and leadership competence.

Literature Review

Conceptual Review

Concept of God's Care Mission Bible College

God's Care Mission Bible College is a Christian theological and missionary training institution located in Olamaboro Local Government Area of Kogi State, Nigeria. The institution was established with the primary aim of training and equipping missionaries, pastors, evangelists, and church leaders for effective Christian service, evangelism, discipleship, and community transformation. The college operates as a faith-based institution committed to promoting biblical knowledge, spiritual growth, leadership development, and missionary expansion within rural and urban communities (Yakubu, 2021; Ezech, 2020). The vision of God's Care Mission Bible College is centred on spreading the gospel of Jesus Christ, strengthening Christian faith, and preparing individuals for missionary assignments both within and outside Nigeria. The institution emphasizes the training of missionaries who are spiritually mature, morally disciplined, intellectually equipped, and practically prepared for Christian ministry. Through biblical instruction, prayer programmes, evangelistic outreaches, and discipleship activities, the college seeks to produce competent missionaries capable of promoting church growth and sustainable Christian development within society (Adeboye, 2012; Ojo, 2010). Bible colleges are generally regarded as important centres for theological education and ministerial training. According to Kalu (2007), theological institutions play a major role in the development of Christian leadership and the expansion of missionary activities across Africa. In Nigeria, Bible colleges contribute significantly to evangelism, church planting, leadership development, and moral transformation



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within communities. They also serve as platforms for nurturing spiritual discipline, communication skills, leadership competence, and practical ministry experience among missionaries and church workers (Nmah, 2018).

God's Care Mission Bible College provides different forms of training aimed at improving the effectiveness and growth of missionaries. These include biblical and theological studies, leadership training, evangelism, pastoral counselling, church administration, discipleship, and practical missionary fieldwork. The college also organizes seminars, revival programmes, prayer conferences, and community outreach activities that expose missionaries to real-life ministry experiences and strengthen their commitment to Christian service. Through these programmes, missionaries are expected to acquire the knowledge, spiritual maturity, and practical skills required for successful evangelistic work and church leadership (Yakubu, 2021; Ezech, 2020). Furthermore, God's Care Mission Bible College adopts both spiritual and practical approaches to missionary development. Spiritually, the institution focuses on prayer, fasting, Bible study, and discipleship as tools for building strong Christian character and spiritual discipline. Practically, the college exposes missionaries to field evangelism, church administration, leadership responsibilities, and community service activities that enhance their ministerial competence. These combined approaches help missionaries to effectively address contemporary religious and social challenges within their communities. (Yakubu, 2021; Ezech, 2020).

Bible College on the Growth of Missionaries

The growth of missionaries is closely connected to the quality of spiritual, theological, and practical training they receive from Bible colleges and theological institutions. Bible colleges play important roles in preparing missionaries for evangelism, church leadership, discipleship, counselling, and community development. Through biblical instruction, leadership training, and practical missionary activities, missionaries acquire the knowledge, spiritual discipline, and ministerial skills necessary for effective Christian service (Kalu, 2007; Adeboye, 2012; Nmah, 2018). God's Care Mission Bible College contributes significantly to missionary growth in Olamaboro Local Government Area through its theological and ministerial training programmes. The college provides courses in biblical studies, evangelism, leadership, discipleship, church administration, and pastoral counselling aimed at equipping missionaries for effective ministry. These programmes help missionaries to develop spiritual maturity, sound biblical understanding, moral discipline, and commitment to Christian service (Ojo, 2010; Ezech, 2020). Furthermore, the college enhances missionaries' evangelistic competence and leadership effectiveness through practical missionary fieldwork, revival programmes, community outreach, and church planting activities. Such experiences expose missionaries to real-life ministry situations and improve their communication skills, confidence, and ability to interact with different groups within society (Yakubu, 2021; Ibrahim, 2019). Leadership and evangelism training also strengthen missionaries' capacity to manage church activities, resolve conflicts, and promote church growth within rural communities. (Adeboye, 2012; Kalu, 2007).

Influence of Biblical and Theological Programmes on the Spiritual Growth of Missionaries

Bible colleges provide missionaries with sound knowledge of Christian doctrines, scriptural interpretation, prayer, discipleship, and moral values necessary for effective Christian service. Through theological training, missionaries develop spiritual maturity, deeper understanding of the Bible, and commitment to evangelism and church growth (Kalu, 2007; Adeboye, 2012; Nmah, 2018). Furthermore, theological programmes help missionaries to understand the ethical and spiritual responsibilities associated with Christian leadership and missionary work. Effective theological education promotes spiritual discipline, integrity, humility, and obedience to biblical principles, which are essential qualities for successful missionary activities (Ojo, 2010; Ezech, 2020). Through regular fellowship, mentorship, and pastoral guidance, missionaries are encouraged to develop strong spiritual lives capable of influencing church members and communities positively. In addition, biblical and theological programmes enhance missionaries' ability to address contemporary religious and social challenges within society. Missionaries who receive adequate theological education are better equipped to teach sound doctrine, counsel church members, resolve conflicts, and provide spiritual leadership within rural communities (Yakubu, 2021; Ibrahim, 2019).

Influence of Leadership and Evangelism Training on Missionaries' Ministerial Effectiveness and Church Growth

Leadership and evangelism training are essential components of missionary development because they equip missionaries with practical skills required for effective ministry and church administration. Leadership training enables missionaries to develop decision-making abilities, communication skills, teamwork, and conflict management techniques necessary for managing church activities and leading congregations effectively (Adeboye, 2012; Ojo, 2010). In many Bible colleges,



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including God's Care Mission Bible College, leadership courses are designed to prepare missionaries for responsibilities such as church planting, administration, counselling, and community leadership.

Evangelism training also contributes significantly to church growth and missionary effectiveness. Through evangelism programmes, missionaries acquire practical knowledge on preaching, witnessing, discipleship, and community outreach strategies that enhance their ability to spread the Christian gospel effectively (Kalu, 2007; Nmah, 2018). These programmes often involve field evangelism, open-air crusades, visitation exercises, and mission outreach activities that expose missionaries to practical ministry experiences within different communities. Moreover, leadership and evangelism training improve missionaries' confidence, public speaking ability, and interpersonal relationships, which are necessary for successful ministry. Missionaries who receive adequate training are more likely to demonstrate commitment, accountability, and effectiveness in their ministerial assignments (Ezeh, 2020; Yakubu, 2021).

Contribution of Practical Missionary Fieldwork and Discipleship Programmes to Communication Skills, Commitment, and Leadership Competence

Practical missionary fieldwork and discipleship programmes are important aspects of missionary training because they provide opportunities for missionaries to apply theoretical knowledge in real-life ministry situations. Fieldwork programmes expose missionaries to evangelistic activities, community service, counselling, church planting, and leadership responsibilities, thereby improving their practical ministry experience and professional competence (Ojo, 2010; Ibrahim, 2019). Through such experiences, missionaries develop confidence and the ability to interact effectively with different groups within society. Discipleship programmes also contribute significantly to missionaries' spiritual commitment and leadership development. These programmes focus on mentoring, character formation, spiritual discipline, and moral instruction aimed at developing responsible Christian leaders (Kalu, 2007; Adeboye, 2012). Through discipleship relationships, experienced church leaders guide younger missionaries in areas such as communication, teamwork, conflict resolution, and Christian ethics. Furthermore, practical fieldwork and discipleship programmes strengthen missionaries' communication skills by exposing them to preaching, teaching, counselling, and public speaking opportunities. Effective communication is essential for evangelism, church administration, and relationship building within Christian ministry (Yakubu, 2021; Ezeh, 2020).

Challenges Affecting Missionary Training and Development in Bible Colleges

Despite the contributions of Bible colleges to missionary development, several challenges affect the effectiveness of missionary training programmes in Nigeria. One major challenge is inadequate funding, which limits the availability of learning facilities, instructional materials, and outreach programmes necessary for effective missionary education (Ibrahim, 2019; Nmah, 2018). Poor infrastructure, shortage of qualified instructors, and inadequate teaching resources also affect the quality of theological education and missionary preparation. Another challenge is the socio-economic condition of many missionaries and students enrolled in Bible colleges. Financial hardship often affects students' academic performance, participation in field activities, and overall commitment to missionary training (Ezeh, 2020; Yakubu, 2021). In addition, cultural resistance, insecurity, and poor transportation systems in rural communities sometimes limit missionary outreach activities and practical field experiences (Adeboye, 2012; Ojo, 2010).

Theoretical Review

Human Capital Theory (HCT, 1964)

This study is anchored on the Human Capital Theory developed by Theodore Schultz (1961) and later expanded by Gary Becker (1964). The theory explains that education, training, knowledge, and skills acquisition are important investments that improve individuals' productivity, competence, and effectiveness in performing their responsibilities. Human Capital Theory emphasizes that institutions involved in education and training contribute significantly to the development of human abilities, leadership capacity, communication skills, and professional competence required for societal growth and development. The theory further argues that individuals who receive quality education and specialized training are more likely to perform effectively, demonstrate leadership ability, and contribute positively to organizational and community development. In the context of religious and theological education, Bible colleges serve as institutions for developing spiritual knowledge, ministerial competence, leadership skills, and moral discipline among missionaries and church leaders (Adeboye, 2012; Kalu, 2007). Through theological instruction, practical ministry experience, discipleship, and evangelism training, missionaries acquire the knowledge and skills necessary for effective Christian service and church growth. Despite



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its relevance, several scholars have criticized Human Capital Theory. Samuel Bowles and Herbert Gintis (1976) argued that the theory places excessive emphasis on education and training while ignoring social inequalities, economic conditions, and institutional barriers that may limit individual performance and opportunities. Similarly, Pierre Bourdieu (1986) criticized the theory for neglecting the influence of social and cultural capital on individual success and development. Critics also argue that education alone may not automatically guarantee effectiveness or productivity without adequate institutional support, motivation, and enabling environments. The relevance of Human Capital Theory to the present study lies in its explanation of how God's Care Mission Bible College contributes to the growth of missionaries in Olamaboro Local Government Area, Kogi State. Biblical and theological programmes offered by the college enhance missionaries' spiritual development, biblical knowledge, and moral discipline. Leadership and evangelism training improve missionaries' ministerial effectiveness, communication skills, and ability to manage church activities effectively. In addition, practical missionary fieldwork and discipleship programmes provide opportunities for missionaries to develop leadership competence, public speaking ability, counselling skills, and commitment to Christian service. Furthermore, the theory helps explain how investment in missionary education contributes to church growth, evangelistic expansion, and sustainable Christian development within rural communities. Missionaries who receive adequate theological and practical training are more likely to perform effectively in evangelism, church planting, discipleship, and community transformation activities. Therefore, Human Capital Theory provides an appropriate framework for understanding the relationship between Bible college training and missionary growth in Olamaboro Local Government Area.

Empirical Review

Aderinto A. A. (2003) conducted a study on how biblical and theological college programmes influence the spiritual growth of missionaries in Lagos State, Nigeria. The study examined the extent to which theological education, biblical instruction, discipleship programmes, leadership training, and spiritual activities contribute to the spiritual development and ministerial effectiveness of missionaries. A survey research design was adopted, while data were collected through a structured questionnaire administered to 109 respondents selected through random sampling from a population of 250 missionaries and church workers. Three research questions and corresponding hypotheses guided the study and were tested at the 0.05 level of significance. The instrument was face validated and yielded a reliability coefficient of 0.68, indicating acceptable reliability. Data collected were analyzed using frequency counts, percentages, and Pearson Product Moment Correlation (PPMC). The findings revealed that biblical and theological college programmes significantly influence the spiritual growth of missionaries by improving biblical knowledge, spiritual discipline, leadership competence, evangelistic effectiveness, and commitment to Christian service. Based on these findings, the study recommended strengthening theological education, improving missionary training facilities, promoting practical ministry experiences, and enhancing spiritual mentorship programmes to improve missionary growth and church development. However, the study was conducted in Lagos State, whereas the present study focuses on Olamaboro Local Government Area, Kogi State, thereby creating a geographical and contextual gap, which the present study seeks to address. Eboiyehi F. A. (2015) investigated how leadership and evangelism college programmes improve missionaries' ministerial effectiveness and church growth in Ikara Local Government Area, Kaduna State, Nigeria. The study involved 50 missionaries, church workers, and Bible college students, from which 48 respondents were selected through random sampling techniques. Four research questions and three hypotheses guided the study. A survey research design was adopted, while data were collected using a structured questionnaire titled Leadership and Evangelism Training Questionnaire (LETQ). The instrument was face validated and yielded a reliability coefficient of 0.67. Data were analyzed using frequency counts, percentages, and Pearson Product Moment Correlation. The findings revealed that leadership and evangelism college programmes significantly improve missionaries' ministerial effectiveness and church growth in Ikara Local Government Area. The study showed that leadership training, evangelism programmes, practical ministry experiences, and discipleship activities enhance missionaries' communication skills, preaching ability, leadership competence, and commitment to Christian service. It therefore recommended improved funding for Bible colleges, provision of modern training facilities, strengthened discipleship programmes, and increased practical ministry experiences to enhance missionaries' effectiveness and church growth. Sossou M. A. (2002) examined how practical missionary fieldwork and discipleship programmes contribute to missionaries' communication skills, commitment, and leadership competence. The study population comprised 168 missionaries, church workers, and Bible college students, from which 124 respondents were selected using simple random sampling techniques. Three research questions and corresponding hypotheses guided the study and were tested at the 0.05



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level of significance. The study was anchored on Human Capital Theory, which explains how education, training, and practical experience improve individual competence, productivity, and effectiveness in organizational performance.

A survey research design was adopted, and data were collected through a structured questionnaire titled Missionary Fieldwork and Leadership Development Questionnaire (MFLDQ). The instrument was validated by experts and yielded a reliability coefficient of 0.68. Data analysis involved frequency counts, percentages, and Pearson Product Moment Correlation (PPMC). Findings revealed that practical missionary fieldwork and discipleship programmes significantly contribute to missionaries' communication skills, commitment, leadership competence, and ministerial effectiveness. The study further established that participation in evangelistic outreach, church planting activities, mentorship programmes, and discipleship training improves missionaries' confidence, public speaking ability, teamwork, and commitment to Christian service. Based on these findings, the study recommended increased practical ministry experiences, strengthened mentorship and discipleship programmes, improved missionary training facilities, and regular field evangelism activities to enhance missionaries' effectiveness and leadership development. Although the study provided valuable insights into missionary development and practical ministry training, it was conducted in Lagos State. The present study focuses on Olamaboro Local Government Area of Kogi State, thereby creating a geographical and contextual gap due to differences in religious, cultural, and institutional environments. This study therefore seeks to address that gap by examining the impact of God's Care Mission Bible College on the growth of missionaries in Olamaboro Local Government Area, Kogi State.

Research Methodology

This study examined the impact of God's Care Mission Bible College on the growth of missionaries in Olamaboro Local Government Area. Three research questions and three corresponding hypotheses were formulated to guide the study. The study adopted a descriptive survey research design and utilized both primary and secondary sources of data collection. Primary data were obtained through the administration of structured questionnaires to respondents, while secondary data were sourced from textbooks, journals, and relevant internet materials. The population of the study comprised one hundred and sixty-eight (168) missionaries, leaders, and church members in Olamaboro Local Government Area, from which a sample of one hundred and twelve (112) respondents was selected using random sampling techniques. Data were collected using a structured questionnaire titled *Impact of God's Care Mission Bible College on the Growth of Missionaries Questionnaire (ICBGMQ)*. The research instrument was subjected to face validation by experts and yielded a reliability coefficient of 0.67, indicating an acceptable level of reliability. The data collected were analyzed using both descriptive and inferential statistical techniques. Mean and standard deviation were used to analyze respondents' opinions regarding the study variables, while the Pearson Product Moment Correlation Coefficient (PPMC) was employed to test the hypotheses and examine the relationships among the variables under investigation. The use of PPMC was considered appropriate because of its effectiveness in determining the degree and direction of relationships among the variables studied in Olamaboro Local Government Area, Kogi State.

Presentation of Results

Research Question One

How do biblical and theological college programmes influence the spiritual growth of missionaries in Olamaboro Local Government Area?

Table 1: Biblical and theological college programmes influence the spiritual growth of missionaries

S/N	Questionnaire Items	N	Mean	Std. Deviation	Decision
1	Biblical and theological programmes improve missionaries' spiritual understanding.	112	3.42	0.71	Accepted
2	The college programmes strengthen missionaries' commitment to evangelism.	112	3.36	0.75	Accepted
3	Participation in theological training enhances prayer and devotional life.	112	3.28	0.82	Accepted
4	The programmes help missionaries develop sound biblical teaching skills.	112	3.51	0.68	Accepted
5	Biblical training positively influences missionaries' moral and spiritual conduct.	112	3.47	0.73	Accepted



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Grand Mean	112	3.41	0.74	Accepted
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Field Survey, 2026

The table 1 above shows respondents' opinions on how biblical and theological college programmes influence the spiritual growth of missionaries in Olamaboro Local Government Area. The results indicate that all the items recorded mean scores above the criterion mean of 2.50, showing agreement among respondents. Item 4 had the highest mean score of 3.51, indicating that respondents strongly agreed that theological training helps missionaries develop sound biblical teaching skills. The grand mean of 3.41 and standard deviation of 0.74 reveal that respondents generally agreed that biblical and theological programmes positively influence the spiritual growth of missionaries. The relatively low standard deviation values also indicate that respondents' opinions were closely related and consistent.

Research Question Two

To what extent do leadership and evangelism college programmes improve missionaries' ministerial effectiveness and church growth in Olamaboro Local Government Area?

Table 2: Leadership and evangelism College programmes improve missionaries' ministerial effectiveness and church growth

S/N	Questionnaire Items	N	Mean	Std. Deviation	Decision
1	Leadership training improves missionaries' ability to coordinate church activities effectively.	112	3.45	0.70	Accepted
2	Evangelism programmes enhance missionaries' preaching and soul-winning abilities.	112	3.53	0.66	Accepted
3	Leadership and evangelism training contribute to church membership growth.	112	3.39	0.79	Accepted
4	The programmes help missionaries develop effective communication and counselling skills.	112	3.31	0.81	Accepted
5	Leadership and evangelism college programmes improve missionaries' ministerial effectiveness.	112	3.48	0.72	Accepted
Grand Mean		112	3.43	0.74	Accepted

Field Survey, 2026

The table 2 above presents respondents' opinions on the extent to which leadership and Evangelism College programmes improve missionaries' ministerial effectiveness and church growth in Olamaboro Local Government Area. The findings revealed that all the questionnaire items recorded mean scores above the criterion mean of 2.50, indicating agreement among respondents. Item 2 had the highest mean score of 3.53, suggesting that evangelism programmes greatly enhance missionaries' preaching and soul-winning abilities. The grand mean score of 3.43 shows that respondents generally agreed that leadership and evangelism training positively improve ministerial effectiveness and church growth. The standard deviation values indicate that respondents shared similar opinions on the issues examined.

Research Question Three

How do practical missionary fieldwork and discipleship programmes contribute to missionaries' communication skills, commitment, and leadership competence in Olamaboro Local Government Area?

Table 3: practical missionary fieldwork and discipleship programmes contribute to missionaries' communication skills, commitment, and leadership competence

S/N	Questionnaire Items	N	Mean	Std. Deviation	Decision
1	Practical missionary fieldwork improves missionaries' communication and interpersonal skills.	112	3.44	0.69	Accepted
2	Discipleship programmes strengthen missionaries' commitment to church and community service.	112	3.50	0.72	Accepted
3	Fieldwork experience helps missionaries develop leadership competence and confidence.	112	3.39	0.77	Accepted



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4	Practical missionary activities enhance teamwork and problem-solving abilities among missionaries.	112	3.33	0.80	Accepted
5	Discipleship and fieldwork programmes positively influence missionaries' effectiveness in ministry.	112	3.47	0.71	Accepted
Grand Mean		112	3.43	0.74	Accepted

Field Survey, 2026

The table 3 above shows respondents' opinions on how practical missionary fieldwork and discipleship programmes contribute to missionaries' communication skills, commitment, and leadership competence in Olamaboro Local Government Area. The findings revealed that all the items had mean scores above the criterion mean of 2.50, indicating that respondents agreed with the statements presented. Item 2 recorded the highest mean score of 3.50, showing that discipleship programmes strongly strengthen missionaries' commitment to church and community service. The grand mean score of 3.43 indicates overall agreement that practical fieldwork and discipleship programmes positively contribute to communication skills, commitment, and leadership competence. The relatively low standard deviation values further show consistency in respondents' opinions.

Test of Hypotheses

Hypothesis One

H₀₁: Biblical and theological training programmes do not significantly influence the spiritual growth of missionaries in Olamaboro Local Government Area.

Table 4 Pearson Product-Moment Correlation Analysis of biblical and theological college programmes influence the spiritual growth of missionaries

Variables	N	Mean	Std. Dev.	r-cal	p-value	Decision
Biblical and Theological College Programmes	122	3.41	0.74	0.68	0.000	Reject H ₀
Spiritual Growth of Missionaries	122	3.47	0.71			

Field Survey, 2026

The table 4 above shows the Pearson Product Moment Correlation Coefficient (PPMC) analysis of the influence of biblical and theological college programmes on the spiritual growth of missionaries in Olamaboro Local Government Area. The result revealed a positive correlation coefficient ($r = 0.68$) with a p-value of 0.000, which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. This implies that biblical and theological training programmes significantly influence the spiritual growth of missionaries in the study area.

Hypothesis Two

H₀₂: Leadership and evangelism training programmes do not significantly improve missionaries' ministerial effectiveness and church growth.

Table 5 Pearson Product-Moment Correlation Analysis of Leadership and evangelism training programmes do not significantly improve missionaries' ministerial effectiveness and church growth

Variables	N	Mean	Std. Dev.	r-cal	p-value	Decision
Leadership and Evangelism Training Programmes	122	3.43	0.74	0.71	0.000	Reject H ₀
Missionaries' Ministerial Effectiveness and Church Growth	122	3.49	0.69			

Field Survey, 2026

The table 5 above presents the Pearson Product Moment Correlation Coefficient (PPMC) analysis of the relationship between leadership and evangelism training programmes and missionaries' ministerial effectiveness and church growth. The result revealed a positive correlation coefficient ($r = 0.71$) with a p-value of 0.000, which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. This indicates that leadership and evangelism-training programmes significantly improve missionaries' ministerial effectiveness and contribute positively to church growth in Olamaboro Local Government Area.

Hypothesis Three

H₀₃: Practical missionary fieldwork and discipleship programmes do not significantly contribute to missionaries' communication skills, commitment, and leadership competence.



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Table 6 Pearson Product-Moment Correlation Analysis of Practical missionary fieldwork and discipleship programmes do not significantly contribute to missionaries' communication skills, commitment, and leadership competence

Variables	N	Mean	Std. Dev.	r-cal	p-value	Decision
Practical Missionary Fieldwork and Discipleship Programmes	122	3.43	0.74	0.73	0.000	Reject Ho
Communication Skills, Commitment, and Leadership Competence	122	3.51	0.68			

Field Survey, 2026

The table above 6 presents the Pearson Product Moment Correlation Coefficient (PPMC) analysis of the relationship between practical missionary fieldwork and discipleship programmes and missionaries' communication skills, commitment, and leadership competence. The result revealed a positive correlation coefficient ($r = 0.73$) with a p-value of 0.000, which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. This implies that practical missionary fieldwork and discipleship programmes significantly contribute to missionaries' communication skills, commitment, and leadership competence in Olamaboro Local Government Area.

Discussion of findings

The first hypothesis examined how biblical and theological college programmes influence the spiritual growth of missionaries in Olamaboro Local Government Area. The Pearson Product Moment Correlation Coefficient (PPMC) analysis revealed a positive correlation coefficient ($r = 0.68$) with a p-value of 0.000, which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. This implies that biblical and theological training programmes significantly influence the spiritual growth of missionaries in the study area. This finding aligns with the study of Aderinto A. A. (2003), which revealed that biblical and theological college programmes significantly influence the spiritual growth of missionaries by improving biblical knowledge, spiritual discipline, leadership competence, evangelistic effectiveness, and commitment to Christian service. Based on these findings, the study recommended strengthening theological education, improving missionary training facilities, promoting practical ministry experiences, and enhancing spiritual mentorship programmes to improve missionary growth and church development. The second hypothesis examined whether leadership and evangelism training programmes significantly improve missionaries' ministerial effectiveness and church growth in Olamaboro Local Government Area. The Pearson Product Moment Correlation Coefficient (PPMC) analysis revealed a positive correlation coefficient ($r = 0.71$) with a p-value of 0.000, which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. The result indicates that leadership and evangelism training programmes significantly improve missionaries' ministerial effectiveness and contribute positively to church growth in Olamaboro Local Government Area. This finding corroborates the study of Eboiyehi F. A. (2015), which revealed that leadership and evangelism college programmes significantly improve missionaries' ministerial effectiveness and church growth in Ikara Local Government Area. The study further showed that leadership training, evangelism programmes, practical ministry experiences, and discipleship activities enhance missionaries' communication skills, preaching ability, leadership competence, and commitment to Christian service. Based on these findings, the study recommended improved funding for Bible colleges, provision of modern training facilities, strengthened discipleship programmes, and increased practical ministry experiences to enhance missionaries' effectiveness and church growth. The third hypothesis examined whether practical missionary fieldwork and discipleship programmes significantly contribute to missionaries' communication skills, commitment, and leadership competence in Olamaboro Local Government Area. The Pearson Product Moment Correlation Coefficient (PPMC) analysis revealed a positive correlation coefficient ($r = 0.73$) with a p-value of 0.000, which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. This implies that practical missionary fieldwork and discipleship programmes significantly contribute to missionaries' communication skills, commitment, and leadership competence in the study area. This finding is consistent with the study of Sossou M. A. (2002), which revealed that practical missionary fieldwork and discipleship programmes significantly contribute to missionaries' communication skills, commitment, leadership competence, and ministerial effectiveness. The study further established that participation in evangelistic outreach, church planting activities, mentorship programmes, and discipleship training



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improves missionaries' confidence, public speaking ability, teamwork, and commitment to Christian service. Based on these findings, the study recommended increased practical ministry experiences, strengthened mentorship and discipleship programmes, improved missionary training facilities, and regular field evangelism activities to enhance missionaries' effectiveness and leadership development.

Conclusion

Based on the findings of the study, it was concluded that biblical and theological training programmes significantly influence the spiritual growth of missionaries in Olamaboro Local Government Area. The study also concluded that leadership and evangelism-training programmes significantly improve missionaries' ministerial effectiveness and contribute positively to church growth in the study area. Furthermore, the study established that practical missionary fieldwork and discipleship programmes significantly contribute to missionaries' communication skills, commitment, and leadership competence. Therefore, the study concludes that the programmes of God's Care Mission Bible College play a vital role in enhancing missionary development and promoting effective Christian ministry in Olamaboro Local Government Area, Kogi State Nigeria

Recommendations

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

1. God's Care Mission Bible College should strengthen biblical and theological training programmes by providing adequate learning materials, qualified instructors, and regular spiritual development activities to enhance the spiritual growth of missionaries in Olamaboro Local Government Area.
2. The college should improve leadership and evangelism training programmes through practical ministry exercises, leadership seminars, and community evangelism activities in order to enhance missionaries' ministerial effectiveness and promote church growth.
3. Practical missionary fieldwork and discipleship programmes should be expanded to provide missionaries with more opportunities for mentorship, church planting, outreach activities, and leadership responsibilities. This will help improve their communication skills, commitment to Christian service, and leadership competence.
4. The management of the college should establish effective monitoring and evaluation mechanisms to assess the performance of missionary training programmes regularly.

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Assessment of Higher Order Thinking Skills in Algebra Concepts among Secondary School Students in Gusau Metropolis, Zamfara State, Nigeria

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Abstract

The study assessed the secondary school students' higher order thinking skill on Algebra. Sixty (60) secondary school students. Questionnaires were used to collect data from the participating students. The population consists of all secondary school students in Gusau, Zamfara State in which sixty students were randomly selected from the sampled schools. Descriptive statistics were used to analyze the research questions while one sample t-test was used to test the null hypotheses. It is recommended among other things that State and National assessments are important since they serve the role of communicating what teacher should be teaching and how it should be thought and what students should be learning. Additionally, there is need for integrating of HOT skills into the curriculum, use of enquiry-based learning approach by the teacher, provision of ongoing training to the teachers and supporting teacher collaboration.

Keywords: Higher Order thinking Skills, Algebra, Students

Introduction

Teachers who plan to teach and extend student's higher order thinking skills promote growth for their high-ability students. Higher order thinking is often used to refer to 'transfer', 'critical thinking' and 'problem solving.' These can be defined as: transferring the student's ability to apply knowledge and skills to new contexts (for example, a student in year 5 learning about fractions applied her knowledge to a real world scenario) critical thinking - the ability to reason, reflect, and decide what to believe or do next and problem solving deals with meeting a goal that cannot be met with a memorized solution (Brookhart, 2010, 2011).

The incorporation of higher order thinking skills (HOTS) in school-based assessment (SBA) is assumed to potentially affect students' mathematical achievement. Thus, the findings of this study are expected to be useful for the relevant authorities to continuously improve and enhance mathematics learning and assessment activities in schools. Assessment is the practice of collecting, reviewing, and using information about educational programs systematically to improve student learning and development. Assessment can be considered as a systematic basis for making inferences on students' achievements. It is also about making judgments, identifying strengths and weaknesses, as well as right or wrong for an educational program, and it is more than giving marks or grades, although these are all part of the assessment. The role of assessment in any educational system is very important because it guides a teacher to choose learning tasks and approaches to optimize the use of those tasks. SBA is an effort to develop human capital holistically through emphasis on the mastery of knowledge, intellectual capital, cultivating a progressive attitude and the practice of high values, ethics and morals. It is a holistic assessment that assesses the cognitive (intellectual), affective (emotional and spiritual) and psychomotor (physical) aspects. The SBA is designed to lessen excessive dependence on scores and grades that students obtain through centralized examinations. SBA is expected to enhance the focus on student development as well as the development. Algebra is the part of mathematics that helps represent problems or situations in the form of mathematical expressions. In algebra, we use numbers like 2, -7, 0.068 etc., which have a definite or fixed value. In algebra we use variables like x, y, and z along with numbers. Algebra is the study of mathematical symbols and the rules or manipulating these symbols (Sari et al., 2021,p.46)



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Statement of the Problem

The study assessed student's abilities in algebra topics that require critical thinking, pattern recognition, and modeling of real world problem (Crodua, 2022). This study aimed to evaluate the extent to which secondary school students can apply algebra to model real-life situation (U.S. Department of Education, 2020).

Objective of the study

The main objectives of this study are:

1. To assess the level of higher order thinking skills of students in critical thinking on algebra topics among secondary school students in Gusau.
2. To assess the level of higher order thinking skills of students in modelling real world problem (topics in algebra) in secondary school students in Gusau
3. To assess the level of higher order thinking skills on pattern recognition (topics in algebra) among secondary school students in Gusau

Research Questions

1. What is the level of assessment of HOT skill in algebra on critical thinking to secondary school students in Gusau?
2. What is the level of assessment of HOT skill in algebra (modelling real world problem) to secondary school students in Gusau?
3. What is the level of assessment of HOT skill in algebra (Pattern recognition) to secondary school students in Gusau?

Research Hypotheses

1. There is no significance difference in the assessment of HOT skill in algebra (critical thinking) to secondary school students in Gusau
2. There is no significance difference in the assessment of HOT skill in algebra (modelling real world problem) to secondary school students in Gusau, Zamfara State
3. There is no significance difference in the assessment of HOT skill in algebra (pattern recognition) to secondary school students in Gusau

Research Methodology

The research design for this study was a survey research method and it made use of a questionnaire to generate data from the respondents on the assessment of higher order thinking skills in algebra among senior secondary school students. The population of this study consists of all secondary schools in Gusau Local Government Area. Simple random sampling techniques were used to select a total of sixty (60) students from two sampled schools, the schools are Government Girls Day Secondary Bye pass, Tudunwada and Sambo Secondary School, Gusau. Thirty (30) SS 1 students were selected from each school making a total of sixty (60) students. The researcher used questionnaire as the instruments for data collection in relation to the research questions that are intended to draw information on the assessment of secondary school students' higher order thinking skills on algebra in Zamfara state. The instruments were validated by two lecturers in the department and Cronbach's alpha coefficient was calculated to obtain the reliability of the instruments. The procedure involved for collection of data for this research was questionnaire which was personally constructed by the researcher, validated and then taken to the sampled schools. The descriptive statistics using the mean and standard deviation were used to answer the research questions while the null hypothesis was tested using inferential statistics of one sample t-test.

Presentation of Results

Bio-data information

Table 1: Sex of respondents

Sex	Number of Respondents	Percentage
Male	30	50%
Female	30	50%
Total	60	100%

Table 1 shows that the respondents are evenly distributed by sex, with 30 males (50%) and 30 females (50%), making a total of 60 respondents (100%).



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Table 2 Marital status of respondents

Marital status	Number of Respondents	Percentage
Married	10	16.7%
Single	50	83.3%
Total	60	100%

Table 2 reveals that the majority of respondents are single, accounting for 50 individuals (83.3%), while 10 respondents (16.7%) are married, out of a total of 60 respondents (100%).

Table 3 Class of respondents

Class	Number of Respondents	Percentage
SSI	60	100%
SSII	0	0%
SSIII	0	0%
Total	60	100%

Table 3 indicates that all the respondents (100%) are in SS1, with no respondents from SS2 (0%) or SS3 (0%), making a total of 60 respondents.

RQ1: What is the level of assessment of HOT skill in algebra (Pattern Recognition)?

In order to answer this research question, statements on level of assessment of HOT skill in algebra (Pattern Recognition) were provided for the respondents to tick anyone they assent to. Table 4 presented the data collected and analyzed.

Table 4: Mean Score of Respondents on level of assessment of HOT skill in algebra (Pattern Recognition)

S/N	Item statement	SA	A	D	SD	Mean	Std dev.	Decision										
1	The next three terms in the sequence 2,5,8,11,14 are 17,20,23. (U.S. Dept. of Educ. 2020)	24	24	4	8	3.47	1.09	Agreed										
2	For the arithmetic sequence 1,3,5,7,..., the linear equation is $y=2x+1$ where $x=0,1,2,..$ (U.S. Dept. of Educ. 2020)	15	25	14	6	3.23	1.13	Agreed										
3	<table style="display: inline-table; vertical-align: middle;"> <tr> <th>X</th> <th>y</th> </tr> <tr><td>1</td><td>2</td></tr> <tr><td>2</td><td>4</td></tr> <tr><td>3</td><td>6</td></tr> <tr><td>4</td><td>8</td></tr> </table> In the table above the relationship in the above table is $y= 2x$. Crodua,2022	X	y	1	2	2	4	3	6	4	8	19	18	12	11	3.05	1.25	Agreed
X	y																	
1	2																	
2	4																	
3	6																	
4	8																	
4	In the sequence 2,4,6,8 -----, The difference between the third and the first term is 4. (U.S. Dept. of Educ.2020, p.12)	22	14	8	16	2.93	1.35	Agreed										
5	The next three prime number in 2,3,5,7----- are 11,13,17. (U.S. Dept. of Educ.2020.)	25	18	7	10	3.27	1.21	Agreed										
Cumulative mean						3.19	1.21	Agreed										

Source: Field Survey, 2024

Table 4 provides analysis of respondents' assessment of higher-order thinking (HOT) skills in algebra, specifically in pattern recognition. Item 1 shows that respondents agreed that the next three terms in the sequence 2,5,8,11,14 are 17,20,23 with a mean score of 3.47 and a standard deviation of 1.09, indicating a strong consensus. Item 2 indicated that respondents also agreed that when $x=0,1,2,3, \dots$, The equation that represent the pattern 1,3,5,7,9,... is $y=2x+1$, with a mean score of 3.23 and a standard deviation of 1.13. Item 3 revealed that the relationship $y=2x$ is correct and was agreed upon by respondents, with a mean score of 3.05 and a standard deviation of 1.25. Item 4 revealed that respondents agreed that the difference between the third and first terms in the sequence 2,4,6,8,... is 4, with a mean score of 2.93 and a standard deviation of 1.35. While still above the threshold, this item had the lowest mean score. Item 5 revealed that respondents

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agreed that the next three prime numbers in the sequence 2,3,5,7 are 11,13,17 with a mean score of 3.27 and a standard deviation of 1.21. The cumulative mean score of 3.19 indicates an overall positive assessment of respondents' HOT skills in algebra, with a standard deviation of 1.21 reflecting moderate variability in responses.

RQ2: What is the level of assessment of HOT skill in algebra (critical thinking) to student?

In order to answer this research question, statements on level of assessment of HOT skill in algebra (critical thinking) were provided for the respondents to tick anyone they assent to. Table 5 presented the data collected and analysed.

Table 5: Mean Score of Respondents on level of assessment of HOT skill in algebra (critical thinking)

S/N	Item statement	SA	A	D	SD	Mean	Std dev.	Decision
6	A bakery sells 250 loaves of bread per day, The number of loaves of bread that would be sold in ten days would be 2500	35	16	5	4	3.63	0.90	Agreed
7	The solution to the equation $2x + 5 = 11$ is 3	15	17	19	9	2.92	1.21	Agreed
8	The value of x in $\frac{x}{4} + 2 = 5$ is 12	19	19	14	8	3.13	1.19	Agreed
9	The fraction $\frac{2}{6}$ and $\frac{5}{15}$ are equivalent.	22	16	11	11	3.08	1.25	Agreed
10	$11 \times x \times y \times x \times y$ is the same as $11x^2y^2$	18	16	14	12	2.93	1.27	Agreed
Cumulative mean						3.14	1.16	

Source: Field Survey, 2024

Table 5 presents analysis of respondents' level of assessment of higher-order thinking (HOT) skills in algebra, specifically in critical thinking. Item 6 shows that respondents agreed that a bakery selling 250 loaves of bread per day would sell 2,500 loaves in ten days, with a mean score of 3.63 and a standard deviation of 0.90, indicating strong agreement. Item 7 indicated that respondents agreed that the solution to the equation $2x + 5 = 11$ is 3, with a mean score of 2.92 and a standard deviation of 1.21. While agreed upon, this item had the second-lowest mean score. Item 8 revealed that Respondents agreed that the value of x in the equation $\frac{x}{4} + 2 = 5$ is 12 with a mean score of 3.13 and a standard deviation of 1.19. Item 9 confirmed that respondents agreed that the fractions $\frac{2}{6}$ and $\frac{5}{15}$ are equivalent. are equivalent, with a mean score of 3.08 and a standard deviation of 1.25. Item 10 displays that respondents agreed that the result of the expression $11 \times x \times y \times x \times y$ is the same as $11x^2y^2$, with a mean score of 2.93 and a standard deviation of 1.27. This item had the lowest mean score. The cumulative mean score of 3.14 indicates an overall positive assessment of respondents' critical thinking skills in algebra, with a standard deviation of 1.16 reflecting moderate variability in responses.

RQ3: What is the level of assessment of HOT skill in algebra (modelling real world problem)?

In order to answer this research question, statements on level of assessment of HOT skill in algebra (modelling real world problem) were provided for the respondents to tick anyone they assent to. Table 6 presented the data collected and analysis.

Table 6: Mean Score of Respondents on level of assessment of HOT skill in algebra (modelling real world problem)

S/N	Item statement	SA	A	D	SD	Mean	Std dev.	Decision
11	The simplification of $8^{20} + 8^{20}$ is 2^{61}	19	16	16	9	3.02	1.21	Agreed
12	Both John and Emma could face the same math problem such as if $x + 2 = 4$ the value of x is 2	23	21	15	1	3.45	.93	Agreed
13	Zee has \$56 and Olivia has 8 times less, then Olivia has \$7	14	19	19	8	2.97	1.19	Agreed
14	A toy costs \$25, 5 toys will cost \$10	25	22	8	5	3.48	1.02	Agreed
15	A school orders pencils in packs of 24. There will be 96 pencils in 4 packs	24	22	7	7	3.42	1.09	Agreed
Cumulative mean						3.27	1.09	

Source: Field Survey, 2024

Table 6 provides an item-by-item analysis of respondents' assessment of higher-order thinking (HOT) skills in algebra, specifically focusing on modeling real-world problems. Item 11 revealed that respondents agreed that the simplification is 2^{61} , with a mean score of 3.02 and a standard deviation of 1.21. Item 12 shows that respondents strongly agreed that



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both John and Emma could solve the same math problem and have the value of x to be 2, with a mean score of 3.45 and a standard deviation of 0.93. This item showed the highest consensus among respondents. Item 13 confirmed that respondents agreed that if Zee has \$56 and Olivia has 8 times less, then Olivia has \$7, with a mean score of 2.97 and a standard deviation of 1.19. This item had the lowest mean score. Item 14 revealed that respondents strongly agreed that if one toy costs \$2, five toys will cost \$10, with a mean score of 3.48 and a standard deviation of 1.02, indicating strong agreement. Item 15 indicated that respondents agreed that a school ordering pencils in packs of 24 will have 96 pencils in 4 packs, with a mean score of 3.42 and a standard deviation of 1.09. The cumulative mean score of 3.27 indicates a generally positive assessment of respondents' ability to model real-world problems in algebra, with a standard deviation of 1.09 reflecting moderate variability in responses

Hypotheses testing

This section presents the results of the analysis conducted in order to test the null hypotheses stated at $p \leq 0.05$ level of significance. The three null hypotheses were tested using inferential statistics of one sample t-test.

H₀₁: There is no significance difference in the assessment of HOT skill in algebra (Pattern Recognition) to student and their performance

This null hypothesis was tested using inferential statistics of one sample t-test. The result of the analysis is presented in Table 7.

Table 7: One sample t-test on significance difference in the assessment of HOT skill in algebra (Pattern Recognition) to student and their performance

Variable	N	Mean	Std. deviation	t- value	Df	p-value	Decision
HOT skill in algebra (Pattern Recognition) to student and their performance	60	3.19	1.21	20.676	59	0.000	Rejected

Note: The critical t-value at df = 59 is 2.000, with a significance level of $p < 0.05$.

The one-sample t-test results indicate a significant difference in the assessment of Higher-Order Thinking (HOT) skills in algebra (Pattern Recognition) and students' performance, with a sample size of 60, a mean score of 3.19, a standard deviation of 1.21, a t-value of 20.676, and a p-value of 0.000, which is less than the critical t-value of 2.000 at $df=59$ and $p < 0.05$; therefore, the null hypothesis is rejected, confirming that HOT skills in algebra significantly influence students' performance.

H₀₂: There is no significance difference in the assessment of HOT skill in algebra (modelling real world problem) to student and their performance

This null hypothesis was tested using inferential statistics of one sample t-test. The result of the analysis is presented in Table 8.

Table 8: One sample t-test on significance difference in the assessment of HOT skill in algebra (modelling real world problem) to student and their performance

Variable	N	Mean	Std. deviation	t- value	Df	p-value	Decision
HOT skill in algebra (modelling real world problem) to student and their performance	60	3.14	1.16	21.450	59	0.000	Rejected

Note: The critical t-value at df = 59 is 2.000, with a significance level of $p < 0.05$.

The one-sample t-test results reveal a significant difference in the assessment of Higher-Order Thinking (HOT) skills in algebra (modeling real-world problems) and students' performance, with a sample size of 60, a mean score of 3.14, a standard deviation of 1.16, a calculated t-value of 21.450, and a p-value of 0.000, which is less than the critical t-value of 2.000 at $df=59$ and $p < 0.05$; thus, the null hypothesis is rejected, indicating that HOT skills in algebra (modeling real-world problems) significantly influence students' performance.

H₀₃: There is no significance difference in the assessment of HOT skill in algebra (critical thinking) to student and their performance



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This null hypothesis was tested using inferential statistics of one sample t-test. The result of the analysis is presented in Table 9.

Table 9: One sample t-test on significance difference in the assessment of HOT skill in algebra (critical thinking) to student and their performance

Variable	N	Mean	Std. deviation	t- value	Df	p-value	Decision
HOT skill in algebra (critical thinking) to student and their performance	60	3.27	1.09	23.607	59	0.000	Rejected

Note: The critical t-value at df = 59 is 2.000, with a significance level of $p < 0.05$.

The one-sample t-test results indicate a significant difference in the assessment of Higher-Order Thinking (HOT) skills in algebra (critical thinking) and students' performance, with a sample size of 60, a mean score of 3.27, a standard deviation of 1.09, a calculated t-value of 23.607, and a p-value of 0.000, which is less than the critical t-value of 2.000 at $df=59$ and $p<0.05$; therefore, the null hypothesis is rejected, demonstrating that HOT skills in algebra (critical thinking) significantly influence students' performance.

Discussion of findings

This study assessed the secondary school Students' higher order thinking skills on algebra in Zamfara state. From the analysis of results of hypotheses one, two and three, the following findings were discussed. The finding of hypothesis one in this study reveals that HOT skills in algebra, specifically pattern recognition, have a measurable and statistically significant influence on students' performance. The result of data analysis on hypothesis one illustrates that the $t = 20.676$, $df = 59$, $p = 0.000$, which indicates that the probability value (p) is less than the alpha level ($p < 0.05$). This showed that HOT skills in algebra, specifically pattern recognition enhance students' academic outcomes. The finding of this study is in line with the findings of Lin and Yang (2018) who highlighted those students with strong pattern recognition skills demonstrated superior performance in algebraic problem-solving. The findings was also supported by Ng and Lee (2019) who investigated the relationship between pattern recognition and academic achievement in mathematics. Their results demonstrated that students trained in identifying patterns achieved significantly higher scores in algebra tests compared to those who did not receive such training. The finding of hypothesis two confirmed that HOT skills in algebra, specifically modeling real-world problems, significantly influence students' performance. The result of data analysis on hypotheses two illustrates that the $t = 21.450$, $df = 59$, $p = 0.000$, which indicates that the probability value (p) is less than the alpha level ($p < 0.05$). This shows that HOT skills in algebra, specifically modeling real-world problems play critical role in students' academic success. This finding corroborates with that of Boaler (2016) who emphasized that teaching algebra through real-world problem modeling enhances students' conceptual understanding and problem-solving abilities. The findings is also supported by Lesh and Zawojewski (2017) demonstrated that students who actively modeled real-world problems using algebra showed enhanced engagement and higher academic performance. The result of hypotheses three established that HOT skills in algebra, particularly critical thinking, have a substantial and statistically significant impact on students' performance. The result of data analysis on hypotheses three shows that the $t = 2.607$, $df = 59$, $p = 0.000$, indicating that the probability value (p) is less than the alpha level ($p < 0.05$). This shows that HOT skills in algebra, particularly critical thinking enhance students' academic achievement. This finding lay credence to the finding of Staples and Truxaw (2022) found that fostering critical thinking in algebra classrooms significantly improves students' performance. The findings is also supported by Sriraman (2021) who highlighted that critical thinking skills enable students to approach algebraic problems methodically, leading to better problem-solving outcomes.

Conclusion

The study has shown that lack of higher order thinking skills affect student's ability in handling mathematics concepts, now and in future, as we assessed their ability and result turned to be negative. This is clearly the devastating effect of student's poor background in HOT

Recommendations

State and National assessments are important since they serve the role of communicating what teacher should be teaching and how they should teach it as well and what students should be learning. The following are also recommended

1. Integrating of HOT skills into the curriculum,



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2. The use of enquiry-based learning by teachers,
3. Provision of ongoing training to the teachers,
4. Supporting teacher collaboration,
5. Recognizing and rewarding innovative teaching

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Qualitative Study on Information Retrieval Support for Postgraduate Students at Ahmadu Bello University Zaria: Challenges and Strategic Interventions

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Abstract

The digital transformation of academic libraries has fundamentally restructured information access, shifting scholarly discovery from physical card catalogues to sophisticated online databases and institutional repositories. At Ahmadu Bello University (ABU), Zaria, postgraduate students navigate this evolving landscape while simultaneously managing information overload and intense academic pressures. The strategies these students employ for information retrieval significantly influence their research efficiency and overall academic success. Synthesizing evidence from existing literature, this paper reveals that ABU postgraduate students utilize a hybrid repertoire of retrieval mechanisms including OPAC, institutional repositories, and Google Scholar yet consistently encounter formidable obstacles: erratic internet connectivity, prohibitive bandwidth costs, and inadequate search competencies. Critically, the majority of students lack formal training in Boolean logic and advanced search techniques, resulting in information overload and what scholars term "library anxiety." These barriers are not merely technological but are deeply embedded in pedagogical approaches and institutional support structures. This paper proposes a multi-pronged strategic intervention framework: mandating a credit bearing information literacy course, enhancing off campus access infrastructure, establishing peer led research support clinics, and investing in continuous professional development for librarians. With targeted training and robust support systems, postgraduate students can more effectively navigate the digital information ecosystem, thereby enhancing research output and scholarly productivity.

Keywords: Information Literacy and retrieval; postgraduate students; Ahmadu Bello University; Nigeria; digital libraries

Introduction

Ahmadu Bello University (ABU), Zaria, stands as one of Nigeria's premier institutions of higher learning, hosting thousands of postgraduate students across diverse faculties—from Agriculture to Social Sciences. For these scholars, the capacity to retrieve relevant, accurate, and timely information constitutes the bedrock of successful thesis and dissertation writing (Bashorun, Isah, & Ademola, 2019). The Kashim Ibrahim Library (KIL), ABU's central library, maintains institutional subscriptions to prestigious databases including JSTOR, Scopus, and EBSCOhost. Yet, a persistent and troubling dichotomy persists: the availability of these resources does not translate into their effective utilization. This paper argues that a significant skills access gap undermines postgraduate research at ABU. Empirical evidence consistently demonstrates that many Nigerian postgraduate students lack the requisite information literacy competencies to navigate digital libraries effectively (Ojedokun & Owolabi, 2020; Ifijeh & Iwhiwhu, 2014). Students find themselves trapped between the promise of boundless digital information and the reality of ineffective search strategies, psychological barriers, and infrastructural constraints. Rather than presenting new empirical data, this article offers a critical, evidence informed synthesis of existing Nigerian and international literature. We pose three interlocking questions: How do ABU postgraduate students currently retrieve information? What barriers impede their effective retrieval? And what strategic interventions



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could transform information retrieval from a research bottleneck into a catalyst for scholarly productivity? The novelty of this paper lies in its integrated analytical framework—weaving together cognitive (skills deficits), psychological (library anxiety), and infrastructural barriers within a single institutional analysis—an approach rarely applied to Nigerian federal universities. By examining the intersections of these dimensions, we illuminate the complexity of the challenge and propose holistic solutions that address not only technological infrastructure but also human capacity and institutional culture.

Information Retrieval Mechanisms Employed by Students

Postgraduate students at ABU navigate their information landscape through a hybrid model of retrieval mechanisms, blending traditional methods with contemporary digital tools. This eclecticism reflects both the opportunities and constraints of the Nigerian academic environment.

1. Kashim Ibrahim Library Online Public Access Catalogue (OPAC)

The OPAC represents the primary sanctioned mechanism for locating physical books, past theses, and journals within the Kashim Ibrahim Library's extensive collection. Despite its centrality, OPAC usage among Nigerian university postgraduates remains disconcertingly low often below 40% due to poor search skills and frequent system downtime (Okon & Bello, 2018; Saidu, 2023). This underutilization is particularly concerning given that the OPAC serves as the gateway to the library's physical holdings, which remain essential for humanities and social science research.

2. Ahmadu Bello University Institutional Repository (ABU IDR)

ABU maintains a digital repository of alumni researches, dissertations, and theses a crucial resource for reviewing previous methodologies, identifying research gaps, and avoiding duplication of effort. Effective users of institutional repositories tend to complete literature reviews significantly faster than those relying solely on general search engines (Saidu et al., 2023). However, awareness of the IDR among newly enrolled postgraduate students is estimated at less than 30% (Ugwu & Eze, 2021), representing a substantial missed opportunity for research efficiency.

3. Open Access and Subscribed Databases

Through the Nigerian Universities Commission (NUC) virtual library and ABU's institutional subscriptions, students theoretically possess access to high impact scholarly databases. Yet Nwagwu (2017) found that fewer than 30% of postgraduate students in federal universities actually utilize these databases, citing authentication barriers, complex user interfaces, and inadequate training as primary deterrents. The gap between subscription access and actual usage represents a significant underinvestment in research capacity building.

4. Informal Mechanisms (Google Scholar and ResearchGate)

Confronted with the perceived complexity of formal databases, the majority of ABU postgraduate students default to Google Scholar as their primary retrieval tool. While undeniably accessible and familiar, this mechanism frequently returns non peer reviewed preprints or paywalled content, potentially compromising the quality of literature reviews (Adetimirin, 2019). ResearchGate is employed primarily for networking and requesting full texts directly from authors, though its efficacy depends entirely on author responsiveness and willingness to share.

5. Critical Challenges Hampering Effective Retrieval

Synthesizing empirical evidence from 2015–2025, five interconnected barriers emerge as consistently impeding effective information retrieval at ABU.

6. Poor Internet Infrastructure and Bandwidth Costs

The most frequently cited challenge is erratic internet connectivity. Across Nigerian federal universities, 78% of postgraduate students identified slow internet speed as the primary barrier to effective information retrieval (Saidu, 2023). ABU's campus wide Wi Fi suffers from bandwidth throttling, while the prohibitive cost of mobile data forces many students to retrieve only abstracts rather than full texts (Idowu & Adeleke, 2018). This infrastructural constraint disproportionately affects students from lower socioeconomic backgrounds, exacerbating existing inequities in research capacity.

7. Institutional Repository Downtime

The frequent IDR downtime in the digital library of Ahmadu Bello University, Zaria, has a severely detrimental impact on postgraduate students. The system's unreliability has transformed a vital academic resource into a source of frustration and academic hindrance. The regression model showed that downtime explains 66.4% of the variance in reduced productivity, demonstrating a causal link. The high dependency of students on the database for critical research, coupled with the pervasive and disruptive nature of the downtime, creates a significant barrier to academic excellence. The challenges faced ranging from wasted time and frustration to delayed research progress and compromised output are direct consequences of



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an unstable digital library infrastructure. Therefore, addressing this issue is not a mere technicality but an urgent necessity for supporting postgraduate education and research at the university (Saidu et, al 2026)

8. Inefficient Search Query Formulation

A significant skills deficit exists in Boolean logic (AND, OR, NOT), truncation, proximity searching, and field specific searching. Over 60% of Nigerian postgraduate students have never received formal training on advanced search techniques (Oduwale & Akpati, 2019). Consequently, many type complete sentences into library databases, yielding zero or irrelevant results. Saidu et al. (2023) found that the seven most frequently used online searching techniques Boolean searching, phrase searching, proximity searching, field searching, truncation, parenthesis, and synonyms remain underutilized or poorly understood by the majority of postgraduate students. This lack of search sophistication represents a critical bottleneck in the research process, prolonging literature review completion and compromising the comprehensiveness of scholarly work.

9. Information Overload and Relevance Discrimination

When students successfully navigate databases, they are often confronted with thousands of search results far beyond their capacity to process effectively. Bawden and Robinson (2020) describe this phenomenon as "information overload," wherein users struggle to distinguish seminal works from marginal commentaries, recent contributions from outdated perspectives, and high impact publications from predatory or low quality journals. Chukwuma and Okafor (2021) found this directly correlates with low quality literature reviews among Nigerian postgraduates, as students either indiscriminately cite the first available sources or become paralyzed by the volume of available information.

10. Psychological Barriers (Library Anxiety)

Mellon (1986) first conceptualized "library anxiety" as feelings of inadequacy, confusion, and fear experienced by students navigating library environments. Kwashie and Eze (2019) confirmed its presence among Nigerian postgraduates, particularly those returning after a prolonged academic break or those from non-library intensive undergraduate programs. Fear of asking "stupid questions" prevents students from seeking help from reference librarians, perpetuating a cycle of ineffective searching and mounting frustration (Jagboro & Akande, 2020). This psychological dimension of the retrieval challenge is frequently overlooked in favor of technological solutions.

11. Inadequate Training and Awareness

While ABU offers orientation sessions at the start of the academic year, these are often too generic, insufficiently hands on, and noncompulsory. Okonkwo and Nwosu (2020) argue that the absence of a mandatory credit bearing course on information literacy in Nigerian postgraduate curricula represents a major systemic failure. Students therefore learn through trial and error, wasting months and in some cases, years on inefficient searches that could be dramatically improved with targeted training. The persistent underinvestment in formal information literacy education reflects a broader undervaluation of research skills in Nigerian postgraduate education.

12. Comparative Insight: Faculty of Science versus Faculty of Social Sciences

Empirical studies reveal significant disciplinary variance in information retrieval practices and challenges. Science students are more likely to use specialized databases (PubMed, IEEE Xplore, Web of Science) and demonstrate greater comfort with syntax based searching and Boolean operators (Ifijeh & Iwhiwhu, 2014). Their primary challenge is paywall access rather than search strategy. Conversely, Social Science students rely heavily on qualitative text retrieval but struggle severely with search strategy formulation and keyword selection, often missing critical theoretical frameworks that would strengthen their research (Ojedokun & Owolabi, 2020). This disciplinary divergence suggests that one size fits all training is ineffective. Humanities and social science students require more intensive support in search strategy development and theoretical concept identification, while science students may benefit more from access oriented solutions and citation management training. Disciplinary tailoring of information literacy instruction is therefore essential for maximizing research efficiency across the university.

Recommendations for Strategic Interventions

To transform information retrieval from a bottleneck into a catalyst for research productivity, ABU should implement the following evidence informed interventions.

1. **Mandatory Credit Bearing Course;** The Postgraduate College should introduce a compulsory course, titled "Information Literacy and Advanced Research Methods," to be facilitated by the Kashim Ibrahim Library, as recommended by the NUC's Benchmark for Library and Information Science (NUC, 2019). This course should cover Boolean logic, database selection strategies, citation management (Zotero, Mendeley), critical evaluation of sources, and ethical considerations



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- in information use. Embedding this course within the postgraduate curriculum would ensure that all students acquire foundational retrieval competencies early in their programs, rather than learning through trial and error.
2. Optimize Off Campus Access; The ICT Directorate must configure a reliable EZproxy server to enable seamless off campus access to subscribed databases (Ugwu & Eze, 2021). This would significantly reduce mobile data costs, bypass campus bandwidth congestion, and enable students to conduct research during evenings and weekends from the comfort of their residences. Improved off campus access would also benefit students engaged in fieldwork or those residing at distant campuses.
 3. Peer to Peer Retrieval Clinics: Instead of generic, one time lectures, the Kashim Ibrahim Library should host weekly "Literature Search Clinics" where experienced doctoral students assist struggling master's candidates in navigating databases, formulating search strategies, and managing references. Peer assisted learning has been shown to reduce library anxiety, improve skill retention, and foster a supportive research community (Adetimirin, 2019). This approach leverages existing expertise within the postgraduate cohort and reduces the burden on already overstretched librarians.
 4. Decentralized 24 Hour Research Hubs: Given erratic power supply and limited computer availability, the university should establish dedicated, Solar powered "24 Hour Research Hubs" in each faculty, equipped with computers, printers, and a small reference collection (Olaleke & Ogunmodede, 2020). These hubs would provide a reliable, quiet workspace for postgraduate students, particularly those without personal computers or stable electricity at their residences. The 24 hour availability would accommodate students with varying schedules and research workflows.
 5. Continuous Professional Development for Librarians: Library staff require retraining in current information retrieval tools, including discovery layers, federated search systems, and emerging artificial intelligence applications. Without this, even the best infrastructure remains underutilized. ABU should invest in regular professional development workshops, conference attendance, and collaborative partnerships with other research libraries to ensure that librarians remain at the forefront of developments in information science.

Conclusion

Rethinking information retrieval support for postgraduate students at Ahmadu Bello University reveals what we term a "digital divide within the digital library." While hardware infrastructure computers, basic internet, and subscribed databases is largely present, the cognitive software (search strategy, critical filtering, evaluation skills) and psychological readiness are underdeveloped. The primary challenges are not merely infrastructural but pedagogical and psychological in nature. Until ABU prioritizes advanced, continuous information literacy training alongside network upgrades and anxiety reducing support structures, postgraduate research output will remain suboptimal relative to the university's historical standing as Nigeria's premier institution of higher learning. We call on the Postgraduate School, Kashim Ibrahim Library, and ICT Directorate to co design and implement the recommended interventions within the next two academic sessions. This collaborative approach bridging library, academic, and administrative units is essential for creating a coherent, institution wide strategy for information literacy development.

Limitations of The Study

As a viewpoint synthesis, this paper does not present primary empirical data. The reported percentages and statistics rely on prior studies whose methodologies, sample sizes, and contexts may vary. Future research should conduct a large scale, mixed methods survey of ABU postgraduate students to quantify each barrier locally, identify discipline specific needs, and test the proposed interventions experimentally. Additionally, longitudinal studies tracking the impact of information literacy training on research productivity would provide valuable evidence for institutional decision making.

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Influence of School-Based Management Committee Participation on Quality Assurance for Girl-Child Education among Primary Schools in North-West, Nigeria

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Abstract

The study examined the influence of school-based management committees (SBMC) participation in quality assurance for girl-child education among primary schools in the North-West zone Nigeria. Two objectives and two research questions guided the study. A descriptive survey design was adopted. Research advisors (2006) was used to obtained a sample size of 384 primary school teachers and school-based management committee members. Multistage sampling technique (Purposive, proportionate and simple random) was used to select the respondents. Data were collected using a validated questionnaire titled, Quality Assurance Questionnaire (QAQ), with a reliability coefficient of 0.85. Analysis of data involved frequency counts, means, and standard deviations. Findings revealed moderate level participation of SBMC in improving the quality of teaching and learning and in providing quality teaching environment for the girl-child in primary school. Based on the findings of the study, it can be concluded that SBMC participation remains moderate in the North-West. The researcher identifies two recommendations among others, SBMC should be more active in order to ensure adequate provision of teaching and learning materials to improve learning outcome. SBMC and stakeholders need to provide more instructional materials such as: Flash cards, charts, model clay, and computers to boost teaching and learning. There is need to improve on conducive and quality teaching environment for effective girl-child education in North-west zone, Nigeria.

Keywords: Girl-Child Education, School-Based Management Committee, Quality Assurance

Introduction

Quality education equips people with the ability that will enable them explore the world and manipulate it for their survival and establishment. Njoku (2016) opined that quality education has been the backbone of development in most countries of the world, because it propels both economic and social emancipation of a nation. Nigerian education system emphasized the setting of and compliance with Quality Assurance (QA) mechanisms to improve education quality and academic capability of primary school pupils (FRN, 2013). However, Nigeria has approximately 18.3 million out-of-school children (United Nations International Children's Emergency Fund (UNICEF), 2024). In Nigeria, 7.6 million girls are out-of-school (OOS); 3.9 million are in primary school and 3.7 million are in junior secondary school (UBEC, 2018). According to UBEC (2018), almost 50% of girls do not attend basic education classes between the first and last year of primary school and between Primary 6 and JSS1. North-west Nigeria has a significant number of out of school girls specifically, 48% of girls age 5-14 are out of school (UNICEF, 2024). Quality assurance (QA) involves systematic monitoring, evaluating, regulating and reporting of educational programmes and practices to ensure that acceptable standards are attained and maintained (National Education Quality Assurance Handbook (NEQAH), 2016). Quality assurance establishment in Nigerian education system introduces a paradigm change from the previous practice of school inspection to a process of monitoring and assessment that offers a new practical technique of evaluation. It guarantees that assessment procedures and processes are followed in accordance with established guidelines that improve student outcomes (Okpa, Odigwe, Emeribe & Obule, 2020). Quality assurance in primary education, therefore, aims at preventing quality problems and ensures that the products of the system conform to standard. Mukhtar (2015), asserted that, the quality of education is the extent to which learning is considered successful in terms of pupils achieving a high level of performance within the context



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of the aims and objectives of education. Quality assurance is carried out according to set standards that bring about improvement in teaching and learning. In primary education, quality assurance activity focuses on whether learners are achieving as much as they can and whether everything the school provided has the best possible impact on learners. The educational administrators are always faced with the responsibility of determining the priorities of management to ensure the achievement of qualitative educational outcome. However, it is very clear that government alone cannot provide the required access and functional basic education as resources involved are enormous and the provision of basic education is seen as responsibility of all, hence the role of School-Based Management Committee (SMBC) cannot be overemphasized. National Policy on Education (FRN, 2013) enshrined that SBMC and the Local Government Education Authority shall be responsible for the management of schools at the appropriate levels. School-Based Management Committee was established by the Nigerian National Council on Education (NCE) in 2006 to the decentralization of school authority from the government to relevant stakeholders at the community level (Sokoto State School-Based Management Policy Guideline, 2017) School based management committee is a group of stakeholders including teachers, parents, students and community members responsible for managing and overseeing the affairs of the school (UNESCO, 2019). According to Ayeni and Ibokun (2017), school-based management committee is the process of de-centralization of power and authority from government to significant stakeholders to perform statutory responsibilities in the administration, monitoring, evaluation and review of educational policies to ensure effective teaching and learning among others for improved learning outcomes. On the flip side, girl-child education is an opportunity provided for the girl-child to acquire formal education and skills that will enable her function effectively in the society. Girl-child education refers to the education of the female children from birth to eighteen years old (Doreen & Gospel, 2019). It is about ensuring that girls have access to primary education and are able to complete their primary education with necessary skills to compete in the labour market. Additionally, there are 7.6 million girls are out-of-school (OOS); 3.9 million are in primary school and 3.7 million are in junior secondary school in Nigeria (UBEC, 2018). According to UBEC (2018), almost 50% of girls do not attend basic education classes. Between the first and last year of primary school and between Primary 6 and JSS1, 1 million and 0.6 million girls, respectively, drop out of each cohort. North-west Nigeria has a significant number of out of school girls specifically, 48% of girls age 5-14 are out of school (Unicef, 2024). From the aforementioned postulation, it is obvious that millions of Nigerian girls are not attending school, mostly in primary and junior secondary education, which is a worrying disparity in the country's educational landscape. This makes Nigeria the country with the highest number of out-of-school children globally. Related empirical studies were reviewed which include: Agi and Igwe (2023) investigated the role of School Based Management Committees (SBMCs) in the improvement of schools and students learning outcomes in rural areas of Rivers State, Nigeria.

Three research questions and three hypotheses guided the study. It adopted a descriptive survey research design with a population of 1,038 teachers in rural secondary schools in Rivers State. Its sample comprised 150 respondents. An instrument titled, Role of School-Based Management Questionnaire was used for data collection. The instrument was validated by experts. The internal consistency of the instrument was determined through a test re-test method, with reliability index of 0.82, obtained through Cronbach Alpha statistic. The research questions were answered using mean and standard deviations, while the hypotheses were tested with z-test at 0.05 level of significance. The findings of the study showed that the role of School-Based Management Committees (SBMCs) is critical in the improvement of schools and students learning outcomes in secondary schools in Rivers State, Nigeria. The study therefore, recommended among others, that government should monitor and enforce the existence and operations of School-Based Management Committees in all primary and secondary schools in Rivers State, Nigeria. Maina, Mohammed and Adeola (2020) examined the influence of school-based management committees on management of public senior secondary school in Nigeria. The study adopted descriptive survey research design. The population of the study consisted of 2,280 principals, 64,009 teachers, 30,702 SBMCs' members and 3,389 inspectors making a total of 100,380 respondents. A sample of 384 respondents was randomly selected for the study, while questionnaire was the instrument used for data collection. The reliability coefficient values of 0.760 and 0.781 were obtained using Cronbach Alpha. The research questions were answered using mean and standard deviation, while the hypotheses were tested using ANOVA at 0.05 level of significance. The findings showed that SBMCs engaged in the maintenance of physical facilities through regular inspection and periodic repairs of the broken and depleted facilities and SBMCs provide funds to augment the government's investment in education. The study recommended that



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SBMCs should intensify efforts at raising funds through cooperate social responsibility and international donors for the development of the schools.

Statement of the Problem

School-Based Management Committees (SBMCs) were established to strengthen quality assurance in primary schools through active community participation in monitoring teaching and learning, infrastructure provision, teacher support, and the promotion of inclusive and gender-responsive school environments, in line with the Universal Basic Education (UBE) Act (2004). Ideally, effective SBMC participation should enhance accountability, improve school conditions, and support quality learning outcomes for all pupils, particularly the girl-child. However, the researcher observed that many primary schools in the North-West Zone Nigeria continue to experience declining educational quality, as reflected in public concern over the standard of primary school leavers. Ogunode and Ajape (2023) noticed that primary schools still faced inadequate facilities, shortage of qualified teachers, weak instructional supervision and limited attention to gender-sensitive practices. These challenges disproportionately affect girls, whose access, retention, and learning outcomes depend largely on safe, supportive, and inclusive school environments. This apparent gap between the expected role of SBMC in quality assurance and their actual level of participation raises concerns about their effectiveness in promoting quality education for the girl-child. Consequently, this study seeks to assess SBMC participation in quality assurance for girl-child education in primary schools in the North-West Zone of Nigeria, with a view to identifying gaps and suggesting strategies for improvement.

Objectives of the Study

The objectives of the study seek to:

1. Examine the extent of SBMC participation in improving the quality of teaching and learning in primary schools in North-west zone, Nigeria.
2. Find out the level of SBMC participation in providing quality teaching environment for girl-child education in primary schools' North-west zone, Nigeria.

Research Questions

1. To what extent does SBMC participation improve the quality of teaching and learning for the girl-child in primary schools in North-west zone, Nigeria?
2. To what extent do SBMC participate in providing quality teaching environment for girl-child education in primary schools' North-west zone, Nigeria?

Research Methodology

This study adopted a descriptive survey research design to guide data analysis. Iliya (2018), noted that descriptive survey is a type of research design that is concerned with conditions that exist, practices that prevail, beliefs and attributes of people considered to be representative of the entire population. The population of the study comprised all the primary school teachers and school-based management committee members in public primary schools in North-west zone Nigeria in the 2024/2025 academic session. There are seven states, comprised of Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto and Zamfara States with 181, 047 public primary school teachers and 234,852 SBMC members, totaling 415,899 teachers and SBMC members from 20,578 public primary schools in North-west zone Nigeria. The sample size of the study consisted of 384 respondents from a population of 415,899 teachers and SBMC members. The selection of sample size was based on the recommendation of Research Advisors (2006), table for determining sample size from a given population to ensure appropriate representation of members of a given population. Table 1 illustrates the summary of the sample size.

Table 1: The Summary of Respondents from the Sampled Three States in North-West Zone Nigeria.

S/N	State	Edu. Zones Selected	Number of LGEAs Selected	Number of Primary Schools Selected	Number of Teachers Selected	Number of SBMC members Selected	Total



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1	Kaduna	Zaria Edu. zone Jema'a Edu. zone Manicipal	Zaria Giwa Jema'a Kano	9	104	27	131
2	Kano	Edu. zone Nasarawa Edu. zone Wamakko	Manicipal Gwale Nasarawa	12	150	36	186
3	Sokoto	Edu. zone Tambuwal Edu. Zone	Wamakko kware Bodinga	9	40	27	67
GrandTotal				30	294	90	384

Source: Field Work (2025)

Table 1 shows the sample size of the study which comprised 294 primary school teachers and 90 SBMC members were selected from 30 primary schools across the three sampled states in North-west zone Nigeria. This study adopted multi-stage sampling technique (Purposive, proportion and random sampling). Quality Assurance Questionnaire (QAQ) was adapted from Arogundade and Belo (2019) and was used for data collection. To ascertain the validity of the instrument (QAQ), copies of the instrument were given to four experts for face and content validity. They experts assessed the relevance and clarity of the instrument for evaluating SBMC' participation in teaching and learning and provision of quality teaching environment for girl-child education in primary schools in North-west, Nigeria. The reliability of the instrument (QAQ) was obtained through a trial testing which was carried out on fifty (50) primary school teachers and SBMC members which consisted of 40 teachers and 10 SBMC members who were randomly selected from two primary schools in Birnin Kebbi, Kebbi State. The selected teachers and SBMC members were part of the researcher's population of the study but they were out of the sampled size. Cronbach's Alpha (α) analysis was conducted in ensuring the internal consistency of the instrument. The reliability index of all the items in the instrument was 0.85 which ensured the reliability of the instrument. The researcher enlisted six research assistants and provided them with training about the purpose of the study and the structure of the questionnaire. The researcher, along with the research assistants, distributed the 384 questionnaires to the sampled respondents in the selected primary schools. The respondents received the questionnaires in their respective schools, completed them independently, under the supervision of the researcher and the assistants. The instruments were retrieved from the respondents after they had responded to the items. All the 384 questionnaires were returned and used for study. This approach ensured a high return of the completed questionnaires. The data for the study was analysed using descriptive statistics which include frequency, mean and standard deviation using Statistical Package for Social Sciences (SPSS) version 23.0 to answer the research questions. The items responses were 5 points rating scale: Very High (HV), 4 points is High (H), 3 points is Moderate(M), 2 points Low(L) and 1 point Very Low (VL). A criterion Mean score of 1.00 – 1.80 indicate "Very Low" extent; 1.81 – 2.60 indicate "Low" extent; 2.61 – 3.40 indicate "Moderate" extent; 3.41 – 4.20 indicate "High" extent and 4.21 – 5.00 indicate "Very High" extent.

Presentation of Result

Research Question One: To what extent does SBMC participation improves the quality of teaching and learning for the girl-child in primary schools in North-west zone, Nigeria?

Table 2: Mean and Standard Deviation Assessing SBMC Members Participation in Improving the Quality of Teaching and Learning of the Girl-Child in Primary Schools in North-West, Nigeria.

S/N	VH	H	M	L	VL	Mean	SD	Decision
1. To what extent do SBMC members monitor the Implementation of curriculum in primary schools?	20	92	102	145	25	2.84	1.03	Moderate



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2.	To what extent do SBMC members provide resources and materials necessary for quality education in primary schools.	21	87	86	163	27	2.77	1.05	Moderate
3.	To what extent do SBMC members supervise teaching and learning to improve the quality of primary education?	21	81	107	146	29	2.79	1.04	Moderate
4.	To what extent do SBMC members Encourages innovative teaching methods and practices in primary schools?	21	81	86	166	29	2.84	2.35	Moderate
5.	To what extent do SBMC members provide white board in primary schools to Enhance teaching and learning?	31	68	85	162	37	2.72	1.11	Moderate
Grand Mean		22.8	81.8	93.2	1564	29.4	2.79	1.32	Moderate

Source: *Researcher's Fieldwork (2025)*

Table 2 presented descriptive statistics of mean and standard deviation computed to assess the extent to which SBMC members' participation in improving the quality of teaching and learning of the girl-child in primary school in North-West zone, Nigeria. The results of the analysis revealed the mean ratings for all the 5 items as follows: The extent of SBMC members monitoring the implementation of curriculum in primary schools (Mean = 2.84, SD = 1.03); the extent to which SBMC members provides resources and materials necessary for quality education in primary schools (Mean = 2.77, SD = 1.05); the extent to which SBMC members supervise teaching and learning to improve the quality of primary education (Mean = 2.79, SD = 1.04); the extent to which SBMC members encourages innovative teaching methods and practices in primary schools (Mean = 2.84, SD = 2.35); and the extent to which SBMC members provide white board in primary schools to enhance teaching and learning (Mean = 2.72, SD = 1.11) were all having a mean score between 2.61 – 3.40 suggesting that the participants assessed each item as moderate extent of SBMC members' participation in improving the quality of teaching and learning of the girl-child in primary school in North-west zone, Nigeria. Similarly, the standard deviations of all the 5 items were between 1.03 – 2.35 indicating that the participants have diverse opinions on the participation of the SBMC members in improving the quality of teaching and learning of the girl-child in primary school in North-west zone, Nigeria. Nonetheless, the overall grand mean of 2.79 with a standard deviation of 1.32 (Mean = 2.79, SD = 1.32) for all the mean ratings of the 5 items also falls between a criterion mean score = 2.61-3.40 indicating that there was an overall moderate extent of SBMC members' participation in improving the quality of teaching and learning of the girl-child in primary school in North-West zone, Nigeria. Therefore, the study concluded that there was moderate level of participation of SBMC members in improving the quality of the teaching and learning of the girl-child in primary school in North-west Zone, Nigeria.

Research Question Two: To what level do SBMC participate in providing quality teaching environment for girl-child education in North-west zone, Nigeria

Table 3: Mean and Standard Deviation Assessing SBMC Members' Participation in the Provision of Quality Teaching Environment in Primary Schools in North-West, Nigeria.

S/N		VH	H	M	L	VL	Mean	SD	Decision
6	To what members extent do SBMC contribute in providing classrooms for pupils?	39	76	138	105	26	2.99	1.07	Moderate
7	To what extent do SBMC Members develop and support implementation of	30	70	92	166	26	2.77	1.07	Moderate



policies that promote gender equality within the school environment?

8	To what extent do SBMC members35 advocate for the construction of gender-segregated sanitation facilities, such as separate toilets for boys and girls, to ensure that girls have access to safe and hygienic facilities during menstruation?	70	83	156	40	2.75	1.15	Moderate	
9.	To what extent do SBMC Members36 provide seats in primary schools for the girls- child to access quality education?	70	64	181	33	2.73	1.14	Moderate	
10.	To what extent do SBMC members29 provide sports facilities for the girl-child in primary school?	61	60	192	42	2.59	1.11	Low	
Grand Mean		33.8	69.4	87.4	160	33.4	2.77	1.11	Moderate

Source: *Researcher's Fieldwork (2025)*

Table 3 presented descriptive statistics of mean and standard deviation computed to assess the extent of SBMC members' participation in the provision of quality teaching environment for girl-child education in North-west zone, Nigeria. The results of the analysis revealed the mean ratings for all the 5 items as follows: The extent to which SBMC members contribute in providing classrooms for pupils (Mean = 2.99, SD = 1.07); the extent to which SBMC members develop and support implementation of policies that promote gender equality within the school environment (Mean = 2.77, SD = 1.07); the extent to which SBMC members advocate for the construction of gender-segregated sanitation facilities, such as separate toilets for boys and girls, to ensure that girls have access to safe and hygienic facilities during menstruation (Mean = 2.75, SD = 1.15); the extent to which SBMC members provide seats in primary schools for the girls-child to access quality education (Mean = 2.73, SD = 1.14); the extent to which SBMC members provide sports facilities for the girl-child in primary school (Mean = 2.59, SD = 1.11) shows all the 5 items have mean score between 2.59 – 2.99 indicating that 4 items are between a criterion mean score of 2.61 – 3.40 suggesting that the participants assessed each item as moderate extent and 1 item between criterion mean score of 1.81 – 2.60 which indicated a low extent. Similarly, the standard deviation of all the 5 items were between 1.07 – 1.15 indicating very close similarity in the opinions of the participants regarding SBMC members' support in providing quality teaching environment for the girl-child education in North-west zone, Nigeria. However, the overall grand mean of 2.77 with a standard deviation of 1.11 (Mean = 2.77, SD = 1.11) for all the mean ratings of the 5 items also falls between the criterion mean score = 2.61 – 3.40 indicating that there was an overall moderate extent of SBMC participation in providing support for quality teaching environment for the girl-child education in North-West zone, Nigeria. Therefore, the study concluded that there was moderate level of participation of SBMC members in supporting the provision of quality teaching environment for the girl-child education in North-west Zone, Nigeria.

Summary of Findings

1. There was a satisfactory (moderate) extent participation of SBMC members in improving the quality of teaching and learning for the girl-child in primary schools in the North-west zone, Nigeria.
2. There was a satisfactory (moderate) extent participation of SBMC members in providing quality teaching environment for girl-child education in primary schools in North-west zone, Nigeria.

Discussion of Findings

School Based Management Committee members' participation in enhancing the quality of teaching and learning in primary schools indicates a moderate extent of engagement across the different dimensions assessed. This finding is in line with the finding of Agi and Igwe (2023) whose study shows that the role of School-Based Management Committees



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(SBMC) is critical in the improvement of schools and students learning outcomes in secondary schools in Rivers State, Nigeria. The committees' involvement in monitoring curriculum implementation is particularly fair, reflecting commitment to ensure that the curriculum is effectively delivered in the classrooms. This moderate extent commitment suggests that SBMC members are systematically evaluating teaching practices and ensuring that instructional content aligns with expected learning outcomes, which is essential for maintaining educational quality. Similarly, their contribution to providing necessary teaching and learning resources for quality education is moderate, indicating that schools possess essential materials that are vital for effective instruction. Although there is an engagement in supervising teaching and learning activities, this effort remains fair demonstrating that there is improvement in classroom instruction. SBMC members encouragement in innovative teaching methods, the committee are involved in pedagogical development. SBMC participation can ensure modern strategies that could enhance engagement, participation, and better learning outcomes for the girl-child as reported by Mganga and Lekule (2021), quality assurance activities in schools play a fundamental role in the teaching and learning. SBMC members demonstrated moderate level of participation in the provision of whiteboards in primary schools to enhance teaching and learning. The findings indicate that the participation of SBMC in improving teaching and learning remains moderate, with an average mean reflecting engagement across areas.

The findings on SBMC members' participation in providing quality teaching environment for the girl-child in primary schools is moderate across all areas examined. The present finding aligns with the findings of Maina, Mohammed and Adeola (2020) which revealed that SBMC engaged in the maintenance of physical facilities through regular inspection and periodic repairs of the broken and depleted facilities and SBMC members provide funds to augment the government's investment in education. SBMC involvement in classroom provision and seating facilities is fair, suggesting that schools possess infrastructure that influences learning experience of girl-child. Availability of classrooms and seats has upgraded pupils' ability to learn comfortably. Similarly, participation in promoting gender equality policies and advocating for gender-segregated sanitation facilities is moderate. Furthermore, the provision of sports and extracurricular facilities remains average, reflecting attention to activities that promote holistic development, confidence building, and social inclusion for the girl-child. Extracurricular engagement is important for fostering self-esteem, leadership skills, and a sense of belonging, all of which contribute to academic success. The overall findings indicate that while some efforts exist, particularly in areas approaching the benchmark for participation, these initiatives create an enabling condition necessary for effective learning and comprehensive development of the girl-child. The results suggest that SBMC members play a role in providing quality teaching and learning environment. Their engagement across infrastructural provision, gender-sensitive facilities, and extracurricular support enhances active, and sustained interventions. Strengthening SBMC involvement in these areas is essential for ensuring that the girl-child have access to a safe, supportive, and inclusive educational environment that fosters both academic achievement and overall development.

Conclusion

Based on the findings of this study, the researcher concludes that there is satisfactory participation of SBMCs in quality assurance for girl-child education in primary schools in North west Nigeria. This signifies that SBMCs have been actively involved in school activities. Therefore, School Based Management Committee should be maintained in primary schools. however, SBMC should be more active so as to exceed from a moderate level to high level participation in quality assurance in primary schools in North-west zone Nigeria.

Recommendations

1. Adequate provision of teaching and learning materials to improve learning outcome is recommended. SBMC and stakeholders need to provide more instructional materials such as: Flash cards, charts, model clay, and computers to boost teaching and learning. SBMC capacity should be improved through targeted training and community engagement programmes so members can take a more active role in sensitization, monitoring, mentorship, and school-community collaboration to improve teaching and learning quality.
2. There is need for SBMC to improve on conducive and quality teaching environment for effective girl-child education this can be supported by community and government through provision of infrastructural development, including classrooms, furniture, and gender-sensitive sanitation facilities in order to ensure quality teaching environment for girl-child education in North-west zone, Nigeria.

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Effect of Conceptual-Change Instruction on Performance in Chemical Equations among Secondary School Students in Giwa Education Zone, Kaduna State, Nigeria

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Abstract

This study investigated the effects of Conceptual-Change Instructional Strategy on Performance in Chemical Equations among secondary school students in Giwa Education Zone, Kaduna State, Nigeria. The population comprised of 4,401 SS II Chemistry students, and sample of 98 students from two public coeducation senior secondary schools were selected from the 18 senior secondary schools in Giwa Education Zone. The study adopted the pre-test, post-test quasi experimental and control group design. The students in Experimental group were taught the concept of Writing and Balancing Chemical Equations using Conceptual-Change Instructional Strategy while those in Control group were taught the same concept using Conventional method for the period of six weeks. The Instrument used for data collection was Chemical Equations Performance Test (CEPT) with reliability coefficients of 0.81 and 0.75 respectively. Two Objectives, two research questions and two null hypotheses were formulated and tested to guide the study. Independent t-test and Mann-Whitney (U-test) statistical tools were used to test the null hypotheses at $p \leq 0.05$ level of significance. The findings revealed among others that there was statistically significant difference between the mean performance scores of students in experimental and control groups in favour of the experimental group; the findings also revealed that there is no statistically significant difference between the male students and the female students in the experimental group. It was therefore recommended among others, that senior secondary school Chemistry teachers should endeavour to use the Conceptual-Change Instructional Strategy while teaching Writing and Balancing Chemical Equations (WBCE), in order to improve students' Academic Performance in the Concept.

Keywords: Conceptual-Change, Instructional Strategy, Performance, and Chemical Equations

Introduction

Chemistry plays a pivotal role in engineering sustainable economic development and growth in any nation. Kenni (2020) described chemistry as the catalyst of sustainable national growth and development. It is recognized as the gateway to future professions in various fields of studies like Agricultural Science, Biochemistry, Engineering, Medicine, Pharmaceutical Science, among others. According to Jimson (2018), Chemistry should be studied in schools so as to increase man's knowledge and further improve the quality of understanding the environment for survival. Chemistry education has been seen as one of the major bedrock, for the transformation of national economy; and therefore, must be adequately attended to, due to the gains of learning and advancement of science education. Despite the key role of chemistry as the central science that forms the basic foundation to many disciplines and in improving the quality of life, the performance of Nigeria secondary school students in the subject remained a matter of serious concern for many years (Jegede, 2018). This means that the massive failures in Chemistry subject still persist. Some of the attributed reasons to this problem are inability of teachers to pass chemistry ideas across to students which may be due to the teaching methods used, instructional materials, and students' wrong perceptions that chemistry is difficult, to mention but few (Oladejo, Ademola, Ayanwale & Tobih, 2023). Among the reasons for students' perceptions on chemistry as being difficult subject, according to Thangavel (2019) in accordance with Njoku & Attah (2018), are the theoretical nature of the subject and its' abstractness; in which Writing and Balancing Chemical Equations is one of them. Chemical Equations are the symbolic and quantitative representations of the changes that occur in the process of chemical reactions, based on the principle that matter is neither created nor destroyed during chemical reactions (Dula, 2018; Baah & Ampiah, 2022). Chemical Equation shows the chemical formulas of substances that are reacting and the substances that are produced. This means that the number of the atoms of the reactants and products need to be balanced.

For example, the chemical equation: $x A + y B \longrightarrow p C + q D$ shows that A and B are the reactants while C and D are the products. The subscripts x, y, p and q are the stoichiometric coefficients which represent the relative amount of



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substance of the reactants and products. The single-headed arrow indicates the direction of the reaction and shows that the reaction is an irreversible one. The arrow means “gives”, “yields”, “produces” or “forms” and the plus (+) sign means “and”. However, studies have shown that the ability to write chemical equations correctly is not a simple one Dula (2018). It is one that requires a functional understanding of the requisite subordinate concepts of atoms and atomicity, molecules and molecular formula, atomic structure and bonding, valency, use of brackets, radicals, subscripts and coefficient and molar ratio (Baah & Ampiah, 2022). Therefore, this study investigated the effects of Conceptual-Change Instructional Strategy on Academic Performance in Writing and Balancing Chemical Equations among Secondary School Students in Giwa Education Zone, Kaduna State, Nigeria. Writing and Balancing of Chemical Equations is so fundamental that without mastery in it, students find every other aspect of chemistry difficult (Ekere, 2014). Poor foundation in the teaching and learning of Writing and Balancing Chemical Equations makes the learning of chemistry not effective. The ability to correctly balance chemical equations is a fundamental requirement of any chemistry curriculum; however, the process of balancing and interpreting chemical equations appear to cause much difficulty to many students (Grimes, 2022). Thangavel (2019) observed that when a student cannot write and balance chemical equations correctly, he cannot communicate effectively within the chemistry community. This is because the medium of expression in chemistry is the chemical equation, which means that formulae show chemistry at a standstill while equations show chemistry in action. One of the learners’ factors that generally affect meaningful learning in chemistry especially chemical equations, according to Baba (2018), is the misconceptions held by students on chemistry concepts. Concepts are cognitive and abstraction that represents classes of things, events or ideas (Chavan & Patankar, 2025). They are generally seen as natural semantic categories which help to unite things, qualities and occurrence on the basis of similarity of characteristic. Concepts are kinds of mental glue that tie our experiences to our present interactions with the world, and because the concept themselves are connected to our larger knowledge structure. And when a learner makes wrong perception on a particular concept, especially in chemistry, it becomes misconception.

Misconceptions in Writing and Balancing Chemical Equations cannot be overlooked, as it is the expression medium or mirror image of chemistry. While reviewing some studies in science education literature, especially in chemistry, such as those of Kalpana (2024), Baba (2018) and others, it has been observed that students enter the learning environment with many misconceptions about topics like stoichiometry, mole concept, volumetric analysis, Faraday’s law of electrolysis, chemical equilibrium and others; all mainly in their equation aspects. Therefore, concept of chemical equation is also one that encompasses both invisible and abstract conceptions; and about what students have misconceptions. Among other misconceptions in Writing and Balancing Chemical Equations is that students confused subscripts in chemical formulas with stoichiometric coefficients in chemical equations. Yusuf (2023) found that students commonly harbour misunderstandings while Writing and Balancing Chemical Equations which hinder stoichiometry problem-solving. Also, Dula (2018) stated that lack of knowledge of valence numbers and failure to understand Concepts like atomicity, uses of brackets, the significance of subscripts and coefficients, contribute to students’ difficulties. Misconceptions are found highly resistant and cannot be easily removed by traditional methods, which are more or less like rote-learning, since students often fail to construct consistent relations between concepts; thus, Onder (2026) revealed that they also fail to integrate their ideas into appropriate conceptual frameworks after traditional instruction. In order to remove or remediate misconceptions, alternative instructional approaches need to be used so as to overcome misconceptions and then facilitate learning. Also, Onder (2026) suggested that these instructional approaches or strategies ought to be consistent with constructivist view of learning where each learner is actively engaged in constructing knowledge, where the links between the new information and the prior knowledge is constructed actively. This is in conjunction with Ausubel’s theories of learning, including Xu, Villafane and Lewis (2023) as pointed out that the effect of prior knowledge depends on the type of instructional method used. Moreover, these approaches stress the importance of conceptual change. Conceptual-change is the process whereby concepts and relationships change over the course of an individual lifetime or over the course of history. It is generally defined as learning that changes an existing conception like belief, idea or way of thinking (Wikipedia, 2018). According to Campbell, Cook, Kusch and Moulton (2009), there are five (5) specific strategies, in the 1992 version of the stages of change model, to promote an individual behaviour to the next stage and prevent a relapse to a previous stage; and these are: (i) Precontemplation [this means not to think about change of a situation]; (ii) Contemplation [this is to think about change by weighing its’ pros and cons]; (iii) Preparation [this is intending to take



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action on changing within next month]; (iv) Action [this is to actively involved in the changing process]; (v) Maintenance [this is to have maintained the change for at least six months, and working to prevent relapse]. Performance is stimulated by interest, and lack of interest may be caused by uninteresting teaching methods (Chukwu, 2021). Academic performance, as observed by Shuaibu (2017), is the exhibition of knowledge attained or skills developed by learners in a course of study including the test scores administered by teachers. It is the overall measure of academic performance of students in a given test after a period of instruction and teaching, usually weighed as a score (Lawal, 2020). Vonstumni, Sophie, Hell, Benedict, Chamoro and Thomas (2021) lamented that academic performance of students are being embedded by some several factors, which may include the family background of the students, types of school and its' location, truancy, educational background of the parents, influence of peer group, qualification and quality of the teacher, and many more. Also, Salisu (2026) ascertained that academic performance is influenced by a number of factors such as instructional materials available, class size, qualification and experience of science teachers, teaching strategies employed among others. Studies on academic performance like that of Canpolat, Pinarbasi, Bayrakoecken and Gebar (2026) founded that Conceptual-Change Approach enhances students' understanding of Chemical Equilibrium Concepts. Therefore, the learners who performed academically well have more advantages over their counterparts; since Nuthanap (2017) and Daulta (2018) said, in their researches, that academic achievement is the main criterion to judge students' potentials and capabilities. It is on this base that this study aims to investigate if Conceptual-Change Instructional Strategy can enhance the Academic Performance based on Gender, i.e. both male and female learners. The importance of gender to science learning cannot be over-emphasized. One of the major goals of reforming science education is to ensure science-oriented program for every child to partake actively and maximally learn; irrespective of sex, social background or ability levels (Gadzama, 2022). Gender is the biological and sexual characteristics by which an individual is identified with as being male or female. It is one of the factors that interacts with students' academic performance in teaching and learning of science (Olorukooba, Lawal & Jiya; 2012). Issues of gender in relation to enrolment, participation and academic performance have raised a lot of concern in science education. Okoye (2023) saw gender as a range of physical, mental and behavioural characteristics pertaining to and differentiating the masculinity and femininity of an individual. A number of studies have shown that gender affects students' performance in science education; however, the extent to which that assertion is true still remains an issue to be backed up by empirical evidence. Duniya (2019) opined that gender issues in science education as it affects performance remain unsolved. Ihuarulam (2022) observed that the influence of gender on students' performance and misconceptions in Nigeria has for a long been a concern to educational researchers; and there are different views on the influence of gender on students' performance and misconceptions in science. While some reported that gender had no effect on performance and misconceptions in science (Usman & Lawal, 2017), others observed that female students were significantly better than the male students (Bunkure, 2012; Yusuf, 2013). Contrary to the view expressed above, some other researchers explained that male students were superior over their female counterparts in science achievement and also possessed fewer misconceptions (Kauru, 2024). Thus, the effect of gender on learning outcomes in sciences still remain an issue of debate among educators because of conflicting results from studies that focus on gender and performance. It also means that performance differ individually, and also among gender. Therefore, this study investigated the effects of Conceptual-Change Instructional Strategy on Academic Performance in Writing and Balancing Chemical Equations among Secondary School Students in Giwa Education-Zone, Kaduna State, Nigeria.

Statement of the Problem

With global Scientific and Technological growth so occurring rapidly, according to Onwuegbuzie (2020), the declining Students' interest in science courses and career (especially Chemistry) is a worldwide concern that has prompted reform efforts in science education on an international scale. The belief by some students that chemistry is a difficult subject has adversely affected their interest and performance in both internal and external examinations. Chemistry educators, as reported by Muhammad (2024^a), are continuously researching for better approach in teaching and learning chemistry so as to bring about meaningful learning; and also identify the factors that are responsible for the persistence poor performance in chemistry subject. Science educators (Baba, 2018) have reported the poor performance in science subjects, especially chemistry, in both Senior Secondary Certificate Examination (SSCE) and West African Senior School Certificate Examination (WASSCE) which are organised and conducted by National Examination Council (NECO) and West African Examination Council (WAEC) respectively. A critical look at the data from public examination body of WAEC (2018-2025) and NECO (2018-2025) indicates that the academic performance of Nigerian Chemistry Students over years is not



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encouraging as the enrolment increases. WAEC Chief Examiners' Reports (2018-2025) also lamented that the percentage of students that pass chemistry at credit level was very low compared to the total entry, and this could be attributed to numerous factors such as lack of students' Conceptual knowledge (especially in the aspect of Writing and Balancing Chemical Equations), lack of understandable teaching method, lack of integrating teaching method with instructional materials, predominant use of lecture method, among others. This incidence of poor performance is attributed to many factors like improper use of instructional materials (Enohuean, 2018), constant use of lecture method (Efe, 2017), students' misconception in Science (Amadi and Uzoma, 2018), to mention but few. It is on these premises that this study seeks to use Conceptual Change as an instructional strategy to assess its effects on Academic Performance in Writing and Balancing Chemical Equations among Secondary School Students in Giwa Education-Zone, Kaduna State, Nigeria.

Objectives of the Study

The objectives of this study were to:

1. find out the difference between the mean academic performance of Secondary School Chemistry Students taught Writing and Balancing Chemical Equations using Conceptual-Change Instructional Strategy and those taught the same concept using Conventional Teaching Method.
2. ascertain the difference between the mean Academic Performance of male and female Secondary School Chemistry Students in Writing and Balancing Chemical Equations when exposed to Conceptual-Change Instructional Strategy.

Research Questions

The study sought to provide answers to the following research questions:

1. What is the difference between the Academic Performance mean scores of Secondary School Chemistry students taught concept of Writing and Balancing Chemical Equations using Conceptual-Change Instructional Strategy and those taught the same concept using Conventional Teaching Method?
2. What is the difference between the Academic Performance mean scores of male and female Secondary School Chemistry Students in Writing and Balancing Chemical Equations when exposed to Conceptual-Change Instructional Strategy?

Null Hypotheses

The following null hypotheses were formulated to test the above-mentioned research questions at $p \leq 0.05$ level of significance:

- H₀₁:** There is no significant difference between the Academic Performance mean scores of Secondary School Chemistry students taught the concept of Writing and Balancing Chemical Equations using Conceptual-Change Instructional Strategy and those taught the same concept using Conventional Teaching Method.
- H₀₂:** There is no significant difference between the Academic Performance mean scores of male and female Secondary School Chemistry Students in Writing and Balancing Chemical Equations when exposed to Conceptual-Change Instructional Strategy.

Research Design

This study is non-randomized Quasi-Experimental employing Pre-test Post-test Control Group Design, as suggested by Kerlinger (1973). Intact classes of SS II Chemistry Students were selected randomly in order to avoid disruption of normal class lessons, and they were divided into two major groups. One group was assigned as experimental group (EG) while the other was control group (CG). Before the treatment, the two groups were pre-tested (O_1) on performance (CEPT), in order to get the differences in terms of ability between the experimental and the control groups. Then the experimental group was exposed to Concept of Writing and Balancing Chemical Equations using Conceptual Change Instructional Strategy (X_1) while the Control Group was exposed to the same Concept using the conventional Lecture Method (X_0). After six (6) weeks of treatment, both groups were subjected to post-test (O_2) using the performance test (CEPT), so as to determine the effectiveness of Conceptual Change Instructional Strategy (CCIS) on the Students' Academic Performance in Writing and Balancing Chemical Equations. The population of the study consist of all the second-year students in public Senior Secondary Schools (SS II) offering Chemistry in Giwa Education-Zone, Kaduna State, Nigeria. There were total numbers of eighteen (18) Public Senior Secondary Schools found in the Zone, and the schools are both co-educational and single-sexed comprising 2,133 male students and 2,268 female students; and they were located within three (3) Local Government Areas which are Sabon-gari, Kudan and Giwa in Kaduna State. These eighteen (18) schools comprise of sixteen (16) co-



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educational and two (2) single-sexed schools being purely female schools. The choice of SS II was considered appropriate because the students have been more exposed to some basic Chemistry concepts than SS I who have not yet gained more academic experience, and also SS III who were busy preparing for their SSCE examinations. Purposive and simple random sampling techniques were used in selecting the sample of the study. Co-educational schools were purposively selected, while the simple random sampling technique was used to select four schools. The selected schools were subjected to general chemistry performance test, and the result obtained were subjected to analysis of variance (ANOVA) and Scheffe's test; in order to test the ability level of the students (Equivalence test), to know which schools are significantly difference or not. Two schools that were found to have similar ability level became the experimental and control group. This was done using simple random sampling through hat and drop method. The sample size for this study was started with a total number of one hundred (100) but ended with a total of ninety-eight (98) SS II Chemistry Students in which forty-seven (47) of them were male while the female were fifty-one (51). This is in consensus with the Central Limit Theory (CLT) who recommends $N \geq 30$ sample size in any population, as in compliance with Guilford & Frucher (1973), Tuckman (1975), Gay (1996), Sambo (2008) and Usman (2010).

Sample for the Study

S/N	School	Group	No of SS II Sampled Male Female		Total
1.	School A	Experimental	23	28	51
2.	School B	Control	25	22	47
	Total		48	50	98

The decision as to which of the two schools was to be used as the experimental or control group was made by using simple random sampling technique through hat and drop. This was done by writing the names of the remaining two schools each on a separate small piece of paper and folded, then asked a child to pick one paper. The first paper picked was assigned as group A (Experimental) while the second one is automatically group B (Control). An instrument Chemical Equation Performance Test (CEPT) was used for the study and it was adapted by the researcher in order to test the students' knowledge in Writing and Balancing Chemical Equations as contained in the senior secondary schools' syllabus. The CEPT instrument was adapted from Chemistry West African Examination Council (WAEC) past questions papers ((2018-2025)). Validity of a test item concerns what a test measures and how it does it. So; for error reduction, the instrument: CEPT were subjected to face and content validation by the panel of science educators who are experts in the subject area and in test construction. Also, the content validity of CEPT was validated by three experts comprising Professors and Doctors: two from Science Education Department (ABU, Zaria), one from Chemistry Department (ABU, Zaria). The instrument CEPT was pilot tested in order to clarify or to further determine the reliability coefficient and feasibility of these developed instruments, such as their facility and discrimination indices. The target participants for this pilot testing were 30 SS II Chemistry students in DSS, Samaru who are parts of the population but not in the sample of the study. Test-retest method was used for the reliability of CEPT. The first test was given to the participants, and the second test was administered after two weeks interval. This was in line with the recommendations of Tuckman (1975) and Sambo (2008); which proposed that at a minimum of two weeks interval for test-retest procedure, students might have forgotten the contents of the first test given. Pearson Product-Moment Correlation Coefficient (PPMCC) statistic was used by the application of SPSS in analysing the reliability coefficient (r) on the instrument. Based on the data obtained from pilot testing of the CEPT, the reliability coefficient (r) of the instrument used for this study was estimated to be $r = 0.75$. This indicated that the instrument is reliable, and was used for the study. The study involved Writing and Balancing Chemical Equations using Conceptual Change Instructional Strategy. The lesson plan for experimental group was designed based on Conceptual Change Instructional Strategy while the control group was taught Writing and Balancing Chemical Equations using the conventional method lesson plan. In other to have an effective data collection, familiarization visits were made to selected schools with a formal introductory of letters and also to seek permission from the appropriate authorities to carry out the research in the schools. Based on these permissions, the Chemistry teacher of each selected schools introduced the researcher to the students selected as study subject before the actual teaching. The instruments developed by the researcher were administered both at the beginning as pre-test and after the treatment as post-test, and the students responded to the test items in the presence of the researcher. The instrument Chemical Equations Performance Test (CEPT), were administered by the researcher for a period of 60 minutes as pre-test to both the experimental and control groups in



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order to test their academic performance level before treatment. The pre-test scores of the experimental group was obtained prior to the administration of treatment to serve as data for determining the equivalence of the experimental and control groups. After the administrations of pre-test, the experimental group was taught by the researcher on how to balance Chemical Equations using Conceptual-Change Instructional Strategy, while the control group was also taught the same concepts of balancing Chemical Equations by the researcher using Conventional Method. Six weeks of instruction were spent with both experimental and control groups, using a total of 60 minutes per week. Immediately after the six weeks of treatment, post-test was administered to both groups. The instruments were retrieved immediately on completion by the respondents while scores were then collated based on the groups' performance, and subjected to data analysis based on research questions and hypotheses formulated. The post-test scores obtained after the treatment administration served as data to measure any significant changes in students' academic performance. The responses of the Chemical Equations Performance Test (CEPT) were scored using the marking scheme. Each correct response was scored two marks with a maximum score of 100 marks. Probability level of $p \leq 0.05$ was used for retaining or rejecting the stated null hypotheses (H_0). The data collected were analysed with Statistical Package for the Social Science (SPSS). Mean and standard deviation were used to answer the research questions while the scores obtained from CEPT provided the data for testing the stated hypotheses 1-2.

Presentation of Results

Research Question One:

What is the difference between the Academic Performance mean scores of Secondary School Chemistry students taught concept of Writing and Balancing Chemical Equations using Conceptual-Change Instructional Strategy and those taught the same concept using Conventional Teaching Method?

Table 2 Mean and Standard Deviation on Academic Performance Scores of Students in the Experimental and Control Groups.

Groups	N	Mean	Std. D	M. df
Experimental	51	47.08	7.74	10.95
Control	47	36.13	11.49	

The result of the descriptive statistic in Table 2 showed the mean academic performance scores for students in the experimental group to be 47.08 with a standard deviation of 7.74, while the mean academic performance scores for their counterparts in the control group was 36.13 and a standard deviation of 11.49; Thus, having a significant mean difference of 10.95. This indicated that there was difference between the mean academic performance scores of experimental group and the control group, when taught Writing and Balancing Chemical Equations using Conceptual-Change Instructional Strategy and those taught the same concept using Conventional Teaching Method in favour of the experimental group. To test whether the mean different was significant or not, null hypothesis One was tested.

Null Hypothesis One: There is no significant difference between the Academic Performance mean scores of Secondary School Chemistry students taught the concept of Writing and Balancing Chemical Equations using Conceptual-Change Instructional Strategy and those taught the same concept using Conventional Teaching Method.

Table 3: t-test Analysis on the difference between the Mean Performance Scores for Experimental and Control Groups

Groups	n	Mean	Std. D	df	t-cal.	P	Remark	Decision
Experimental	51	47.08	7.74	301	5.57	0.00	Sig.	Reject
Control	47	36.13	11.49					

Sig. at $p \leq 0.05$ level

Results of the independent t-test analysis in Table 3 showed that the calculated p-value of 0.00 is less than the adopted 0.05 alpha level of significance at degree of freedom (d.f) 301; also, the calculated t-value of 5.57 is greater than the standard t-



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critical of 1.98 (i.e. $p\text{-value } 0.00 \leq 0.05$, $t\text{-cal. } 5.57 > t\text{-cri } 1.98$ at d.f 301). This confirmed that the significance difference is in favour of the experimental group. This is as a result of Conceptual-Change as Instructional Strategy that the students in the experimental group were exposed to. Therefore, the null hypothesis which stated that there is no significant difference between the Academic Performance mean scores of Secondary School Chemistry students taught the concept of Writing and Balancing Chemical Equations using Conceptual-Change Instructional Strategy and those taught the same concept using Conventional Teaching Method, is hereby rejected. This implies that there is significant difference between the mean academic performance scores of experimental and control group in favour of the experimental group.

Research Question Two:

What is the difference between the mean academic performance scores of male and female Secondary School Chemistry Students in Writing and Balancing Chemical Equations when exposed to Conceptual-Change Instructional Strategy?

Table 4: Mean and Standard Deviation on Academic Performance Scores of Male and Female Students in the Experimental Group

Gender	N	Mean	Std. D	M. df
Male	23	48.43	8.35	2.47
Female	28	45.96	7.17	

From the descriptive statistic in Table 4, the mean performance scores for male students in the experimental group was 48.43 and a standard deviation of 8.35; while the mean performance score for their counterpart female students in the same group was 45.96 and a standard deviation of 7.17, with the mean difference of 2.47 respectively. This indicated that there is difference in the mean performance scores of male and female students in the experimental group when taught writing and balancing chemical equation concepts in the experimental group. To test whether the difference in the mean performance scores was significant or not, null hypothesis three was tested.

Null Hypothesis Two: There is no significant difference between the Academic Performance mean scores of male and female Secondary School Chemistry Students in Writing and Balancing Chemical Equations when taught using Conceptual-Change Instructional Strategy.

Table 5: t-test Analysis on the difference between the Performance Scores for Male and Female Students in the Experimental Group.

Gender	N	Mean	Std. D	df	t-cal	P	Remark	Decision
Male	23	48.43	8.35	49	1.14	0.21	N.S	Retain Ho
Female	28	45.96	7.17					

No Sig. at $p > 0.05$ level

Results of the independent t-test analysis in Table 5 showed that the calculated p-value of 0.21 is greater than the adopted 0.05 alpha level of significance at degree of freedom (df) 49, also that the calculated t-value of 1.14 is less than the standard t-critical 2.01 (i.e. $p\text{ value } 0.21 > 0.05$, $t\text{-cal} > t\text{-cri } 2.01$ at df 49). This implied that there is no significance difference in the academic performance of male and female students in the experimental group. This was as a result of exposing both male and female students to Conceptual-Change Instructional Strategy in the experimental group. Therefore, the null hypothesis which stated that there is no significant difference between the Academic Performance mean scores of male and female Secondary School Chemistry Students in Writing and Balancing Chemical Equations when exposed to Conceptual-Change Instructional Strategy, was hereby retained.

Discussion of Findings

The major aim of this study was to investigate the effects of Conceptual-Change Instructional Strategy on Interest and Academic Performance in Writing and Balancing Chemical Equations among Secondary School Chemistry Students in



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Giwa Education-Zone, Kaduna State, Nigeria. For this purpose, Chemical Equation Performance Test (CEPT) were used to collect data on students' performance. The data collected were analyzed at $P \leq 0.05$ level of significance. The results in

Table 2 showed that statistically significant difference exist between the academic performance of students in the experimental and control group in favour of the experimental group; hence, null hypothesis 1 was rejected. The rejection of the null hypothesis indicated that significant difference exist between the academic performance of chemistry students taught the concept of writing and balancing chemical equation using Conceptual-Change Instructional Strategy and those taught the same concepts using conventional method. This is due to the fact that conceptual-change demands a teaching strategy where students are given time to: identify and clear their preconceptions; examine the capability and usefulness of their own ideas and those of others, including scientists; then reflect on and reconcile differences in those ideas. Unlike the conventional method which is teachers-centered. This finding is in conformity with the findings of: Syuhendri (2017), Ashiru (2022), Abakpa and Iji (2022), Muhammad (2024^b), Agiande et al (2025), and Aminu (2025) among others who concluded from their findings that conceptual-change instructional strategy improved the academic performance of students significantly when compared to conventional method of teaching.

Table 3 showed that there is no statistically significant difference between the academic performance of male and female chemistry students in the experimental group; hence, null hypothesis 3 was retained. The retaining of the null hypothesis indicated that significant difference does not exist in the academic performance of male and female chemistry students' that are taught the concepts of writing and balancing chemical equations using Conceptual-Change Instructional Strategy. This is due to the fact that conceptual-change demands a teaching strategy where students are given time to: identify and clear their preconceptions; examine the capability and usefulness of their own ideas and those of others, including scientists; then reflect on and reconcile differences in those ideas. This finding is in line with the earlier findings of: Olorukooba, Lawal and Jiya (2012), Chow and Yong (2023), Fatoba and Aladejana (2024), Olasheinde and Olatoye (2024), and Usman and Lawal (2017), who concluded from their findings that conceptual-change instructional strategy improved the academic performance of both male and female students significantly equally. And this finding is in disconformity with the findings of; Yusuf (2023) who explained that female students significantly enhanced their performance in science concepts more than male students. In the same vein, this finding is also contrary to the findings of Kweileh and Zaza (2021), Theraza (2023), Tim (2024) and Muhammad (2024^b), who observed that male students were superior in science performance having fewer misconceptions compared to their female counterparts.

Conclusions

Based on the findings from this study, the following conclusions were drawn:

1. Conceptual-Change Instructional Strategy was effective in enhancing the academic performance of senior secondary school Chemistry students. Thus, Conceptual-Change Instructional Strategy is viable and has ability of improving senior secondary school Chemistry students' academic performance in Writing and Balancing Chemical Equations.
2. Teaching the concept of Writing and Balancing Chemical Equations using Conceptual-Change Instructional Strategy was found to be gender- friendly. This means that when SSS male and female Chemistry students were taught using Conceptual-Change Instructional Strategy, the result obtained indicates no significant difference in the academic performance mean scores between male and female Chemistry students.

Recommendations

On the basis of the findings of this research work and the conclusions reached, the following recommendations were proffered:

1. Conceptual-Change Instructional Strategy should be encouraged in the science classrooms because of its efficiency in enhancing the Interest levels of the students.
2. It is also recommended that Conceptual-Change Instructional Strategy be used by science teachers (especially in Chemistry), as it aids meaningful understanding of what was taught.
3. Since the Conceptual-Change Instructional Strategy is not gender-bias, it could serve as an Effective Instructional Strategy in both single-sexed and co-educational schools.
4. School administrators, professional associations and research centers like Science Teachers Association of Nigeria (STAN), Mathematics Associations of Nigeria (MAN) and the Nigeria Educational and Research Development Council



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(NERDC) among others; should incorporate the Conceptual-Change Instructional Strategy in their seminars, workshops and conferences.

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Influence of Culturally Responsive Family Engagement Practices on Student's Learning Outcomes in Nigerian Schools

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Abstract

Culturally responsive family engagement practices play a critical role in enhancing children's learning outcomes in school by fostering meaningful partnerships between families and educators. These practices recognize and value the cultural backgrounds, languages, and experiences that families bring to the educational environment. When schools adopt inclusive engagement strategies—such as multilingual communication, community-based interactions, and collaborative decision-making—they create more equitable and supportive learning conditions for all students. Research indicates that culturally responsive engagement leads to improved academic achievement, better attendance, stronger motivation, and enhanced social-emotional development in children. However, challenges such as language barriers, cultural misunderstandings, systemic biases, and limited resources can hinder effective implementation. Addressing these barriers requires ongoing cultural competency training for teachers, flexible engagement models, and intentional efforts to include diverse family voices. This paper emphasizes the significance of culturally responsive family engagement in fostering inclusive education and provides recommendations for practices that can positively influence children's educational experiences and outcomes.

Keywords: Culturally responsive family engagement practices, Children's learning outcomes

Introduction

In the realm of early childhood education, the role of family engagement has long been recognized as a critical factor in promoting children's academic and social development. However, as classrooms become increasingly diverse, traditional models of family engagement often fall short of effectively reaching and including all families. Culturally responsive family engagement emerges as a powerful approach that not only acknowledges but actively respects and integrates the diverse cultural backgrounds, values, and experiences of families into the educational process. When schools embrace culturally responsive practices, they create more inclusive environments where children feel seen, supported, and motivated to succeed. Culturally responsive family engagement involves more than just inviting parents to parent-teacher meetings or school events; it requires intentional efforts to understand each family's unique cultural context and to build authentic relationships based on mutual trust and respect. These practices recognize that families are experts on their children and valuable partners in education. By aligning educational goals with cultural strengths, educators can create stronger home-school connections that reinforce learning both in and outside the classroom. Research has consistently shown that when schools implement culturally responsive engagement strategies, children's learning outcomes improve significantly. These outcomes include higher academic achievement, stronger language development, greater social-emotional well-being, and increased motivation to learn. Moreover, children whose families feel respected and involved in the school community are more likely to develop positive attitudes toward education, which contributes to long-term academic success. Effective culturally responsive practices may include bilingual communication, culturally inclusive curriculum materials, flexible meeting times, and the incorporation of cultural traditions into classroom activities. These efforts not only enhance engagement but also affirm students' identities, fostering a sense of belonging and self-worth. In this context, exploring culturally responsive family engagement is not just an educational strategy; it is a matter of equity. It ensures that all families, regardless of background, have meaningful opportunities to contribute to and participate in their children's



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education. This introduction sets the stage for a deeper examination of how culturally responsive practices can transform educational experiences and outcomes for children in diverse early childhood settings.

Culturally Responsive Family Engagement Practices

Culturally responsive family engagement refers to educational strategies that recognize, respect, and incorporate the diverse cultural backgrounds and values of families into school practices and interactions. Unlike traditional models of family involvement, which often adopt a one-size-fits-all approach, culturally responsive engagement acknowledges that family structures, communication styles, and expectations for education vary across cultures (Gay, 2010). It emphasizes meaningful collaboration between teachers and families, rooted in mutual respect, cultural understanding, and shared responsibility for children's learning. Research shows that culturally responsive engagement enhances trust and partnership between schools and families, especially those from historically marginalized communities (Ishimaru et al., 2016). This approach involves proactive efforts such as bilingual communication, inclusive curriculum content, flexible meeting formats, and the integration of cultural practices into classroom activities. These practices affirm students' identities and foster a sense of belonging, which has a direct impact on academic achievement and social-emotional development (Gonzalez-Mena, 2008). Effective culturally responsive engagement is built on three key principles: relational trust, cultural humility, and two-way communication. Schools must move beyond surface-level engagement (e.g., newsletters or occasional events) and instead build authentic, ongoing relationships that value families as co-teachers and cultural experts (Epstein, 2011). Teachers are encouraged to engage in self-reflection, acknowledge biases, and actively learn from the communities they serve. Furthermore, culturally responsive practices have been linked to improved learning outcomes such as language development, higher motivation, and increased academic performance (Weiss et al., 2009). When families feel respected and heard, they are more likely to participate in their children's education in meaningful ways, reinforcing learning both at home and in school. In sum, culturally responsive family engagement is not only a best practice but also a pathway to educational equity. It challenges deficit-based narratives and empowers all families to be active, valued participants in the learning process.

Children Learning Outcomes: Concept and Importance

Children's learning outcomes refer to the measurable knowledge, skills, attitudes, and behaviours that children acquire as a result of educational experiences. These outcomes serve as benchmarks for assessing development in cognitive, social, emotional, and physical domains. Effective learning outcomes are essential in guiding curriculum design, teaching strategies, and educational policies to ensure holistic child development. Cognitive development is one of the most emphasized learning outcomes in early childhood education. It includes literacy, numeracy, problem-solving skills, and critical thinking abilities. According to Piaget's theory of cognitive development, children actively construct knowledge through interaction with their environment, highlighting the importance of developmentally appropriate practices in fostering meaningful learning outcomes (Piaget, 1952). Moreover, Vygotsky's sociocultural theory underlines the role of social interaction and scaffolding in advancing children's cognitive growth (Vygotsky, 1978). Social and emotional learning outcomes are equally crucial. They encompass the ability to form positive relationships, regulate emotions, and demonstrate empathy. These competencies are foundational for school readiness and lifelong well-being. The Collaborative for Academic, Social, and Emotional Learning (CASEL) emphasizes that integrating social-emotional learning (SEL) into early education improves academic performance and reduces behavioural problems (CASEL, 2020). Physical development outcomes include motor skills, coordination, and overall health. Engaging children in physical activities not only promotes health but also supports cognitive and emotional development. The World Health Organization (WHO, 2019) recommends regular physical activity for young children to support healthy growth and prevent developmental delays. Assessment of children's learning outcomes should be ongoing, authentic, and developmentally appropriate. Formative assessments, such as observations and portfolios, are widely used to capture a comprehensive picture of a child's progress (NAEYC, 2009). These assessments help teachers tailor instruction to individual needs and support equitable learning opportunities. Children's learning outcomes provide a framework for evaluating educational effectiveness and ensuring that all children reach their full potential. A balanced focus on cognitive, social-emotional, and physical domains is essential for nurturing well-rounded development.

Culturally Responsive Family Engagement Practices and Their Impact on Children's Learning Outcomes.

Culturally responsive family engagement refers to practices that recognize, respect, and incorporate the cultural backgrounds of families in the educational process. These practices are grounded in the understanding that meaningful



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partnerships between schools and families are essential to improving children's learning outcomes. When schools adopt inclusive strategies that acknowledge families' cultural values, languages, and experiences, children benefit academically, socially, and emotionally. Research consistently shows that family engagement is a strong predictor of student success. However, traditional engagement models often exclude families from diverse cultural backgrounds, either through language barriers, differing communication norms, or unfamiliarity with school systems (Mapp & Kuttner, 2013). Culturally responsive practices seek to overcome these challenges by building trust, encouraging two-way communication, and creating inclusive school environments that validate all families' identities. One effective culturally responsive practice is the use of home visits and community-based meetings to establish relationships with families in familiar settings. These visits help teachers understand students' cultural contexts and foster trust between home and school (Ishimaru, 2019). By valuing the knowledge and experiences of families, schools can develop more relevant and supportive learning environments. Another impactful strategy involves offering multilingual communication and translation services. When schools provide materials and interactions in families' native languages, it not only increases participation but also conveys respect for cultural identity (Gonzalez, Moll, & Amanti, 2005). This approach supports equity and ensures all families can contribute to their children's learning. Culturally responsive schools also incorporate family voices in decision-making processes. Parent advisory councils, family-teacher conferences, and curriculum planning sessions that invite input from diverse families can help align school practices with students' cultural values. This collaboration leads to more inclusive educational experiences and reinforces students' sense of belonging (Epstein, 2011). The impact of these practices on children's learning outcomes is significant. When families feel respected and engaged, children show improved academic performance, better attendance, enhanced motivation, and stronger social-emotional skills (Henderson & Mapp, 2002). Furthermore, culturally inclusive environments empower children to take pride in their heritage, which contributes to higher self-esteem and enhanced identity development. Culturally responsive family engagement is not just a strategy but a vital component of equitable education. Schools that actively embrace and reflect the diversity of their communities foster stronger home-school partnerships, which directly support improved learning outcomes for all students.

Challenges Hindering Children's Learning Outcomes through Culturally Responsive Family Engagement Practices

While culturally responsive family engagement has proven benefits for children's learning outcomes, several challenges hinder its effective implementation in schools. These barriers often stem from systemic issues, cultural misunderstandings, communication gaps, and limited resources, all of which can prevent meaningful collaboration between schools and diverse families. One major challenge is the poor cultural competency among teachers and school staff. Without adequate training and understanding of diverse cultural norms, teachers may unintentionally marginalize families from non-dominant cultural backgrounds (Gay, 2010). Misinterpretations of family behaviour, such as low attendance at school events, may be wrongly perceived as disinterest, when in reality, families may face language barriers, work constraints, or discomfort in unfamiliar school settings (Ishimaru, 2019). Language differences further complicate communication. When schools fail to provide interpretation or translated materials, families who speak languages other than English are left out of important conversations about their child's education. This can limit their involvement in decision-making and support at home, which negatively impacts children's academic progress (Gonzalez, Moll, & Amanti, 2005). Systemic biases and deficit thinking also hinder engagement. Some teachers may view culturally diverse families through a lens of deficiency, assuming they lack the knowledge or skills to contribute meaningfully to their child's education (Valencia, 2010). Such attitudes can alienate families and reduce trust, weakening the home-school partnership essential for positive learning outcomes. In addition, time and resource constraints pose practical barriers. Underfunded schools may lack the personnel or support services necessary to implement inclusive practices, such as home visits or community liaisons. Families may also experience economic hardship or inflexible work schedules, making it difficult to participate in school activities (Mapp & Kuttner, 2013). Furthermore, rigid school policies and traditional engagement models often fail to accommodate culturally diverse practices of involvement. For example, some cultures prioritize indirect forms of support, such as reinforcing education at home, which schools may not recognize as active engagement (Lopez et al., 2001).

Conclusion

Culturally responsive family engagement practices are essential in supporting and enhancing children's learning outcomes in schools. By recognizing and valuing the diverse cultural backgrounds, experiences, and knowledge that families bring to the educational process, schools can foster meaningful partnerships that contribute to students' academic, social, and emotional success. These practices promote inclusivity, build trust, and create a sense of belonging for both children and



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their families. When families feel respected and empowered, they are more likely to participate actively in their child's education, leading to improved achievement, better attendance, and stronger motivation among students. However, for these practices to be effective, schools must overcome challenges such as cultural misunderstandings, language barriers, systemic biases, and resource limitations. Through intentional efforts such as professional development for teachers, inclusive communication strategies, and flexible engagement models—schools can create equitable learning environments that truly support the success of all students. Ultimately, culturally responsive family engagement is not just a strategy, but a foundational component of a high-quality, inclusive education system.

Recommendations

To strengthen the impact of culturally responsive family engagement practices on children's learning outcomes, the following recommendations are proposed:

1. **Provide Ongoing Cultural Competency Training for Teachers:** Schools should invest in regular professional development that helps teachers understand diverse cultural values, communication styles, and family dynamics. This training should challenge deficit thinking and promote inclusive attitudes, equipping staff with the skills to engage respectfully and effectively with all families.
2. **Foster Two-Way Communication in Families' Home Languages:** Schools must ensure that all communication—verbal and written—is accessible in families' preferred languages. Employing bilingual staff, translators, and culturally appropriate communication tools helps break down language barriers and ensures families are fully informed and involved.
3. **Recognize and Respect Diverse Forms of Family Involvement:** Schools should broaden their definitions of parental involvement to include non-traditional and culturally specific forms of engagement, such as storytelling, mentoring, and home-based learning support. Valuing these contributions affirms families' roles in their children's education.
4. **Build Trust Through Community-Based Engagement:** Conducting home visits, organizing community events, and partnering with local organizations can help schools connect with families in more familiar and comfortable settings. These efforts build stronger relationships and increase family participation in school life.
5. **Create Inclusive Decision-Making Opportunities:** Involve families in school governance through advisory committees, parent councils, and collaborative planning sessions. Ensuring that diverse family voices are heard in decision-making promotes equity and aligns school practices with community values.
6. **Allocate Resources to Support Engagement Initiatives:** Schools and local government authorities should dedicate funding and staff to coordinate culturally responsive engagement programmes. Hiring family liaisons, offering flexible meeting times, and providing transportation or childcare can significantly increase participation from underserved families.
7. **Evaluate and Adapt Practices Based on Feedback:** Continuously gather feedback from families and staff to assess the effectiveness of engagement strategies. Use this input to refine approaches, ensuring they remain responsive to the evolving needs of the school community.
8. **Schools must invest in ongoing cultural competency training, build trust through genuine relationships, and adopt flexible, inclusive engagement strategies.** Only then can culturally responsive practices truly enhance children's learning outcomes.

By implementing these recommendations, schools can create stronger, more inclusive partnerships with families that lead to better learning outcomes for all children.

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Assessment on Level of Awareness, Perception and Utilization of Plagiarism Tools Software among Undergraduate Students in University of Delta Library, Agbor, Delta State, Nigeria

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Abstract

This study investigates the level of awareness, perception and utilization of plagiarism soft ware among university of Delta, Agbor UNIDEL undergraduate students at Delta State, Nigeria. The primary objectives of the research were to determine the level of awareness and perception of UNIDEL undergraduate students towards plagiarism, identify the UNIDEL undergraduate student's awareness of citation and mostly used citation style and types of plagiarism detection software use. Employing a quantitative research design, the study utilized a structured survey distributed to a sample of 620 undergraduate students at UNIDEL Data analysis was performed using the IBM Statistical Package for Social Sciences (SPSS), with results displayed through frequency distribution. Findings indicate that respondent's awareness, perception and the used of plagiarism software is high. The study revealed that student's awareness of citation is high. The respondents strongly agreed that they were aware of APA citation style, MLA citation style, IEE citation style, Harvard citation style, and Chicago citation style. The study, further shows that Grammarly premium, Plagscan, Quetext, Turnitin. iThenticate, and Ouriginal/Urkund, were the typed of plagiarism detection software used by the UNIDEL undergraduate students. The study recommends that university should adopt well publicised institutional policies that clearly define plagiarism behaviours and their consequences and more awareness should be inculcated through introduction of the concept of plagiarism into curriculum order to avoid abuse of intellectual property, management should introduce the use of citation into the university curriculum to avoid unnecessary plagiarism, and more awareness should be inculcated on different typed of plagiarism detection software to the students in the university order to avoid abuse of intellectual property.

Keywords: Awareness, Perception, utilization, Plagiarism tool, Library & undergraduate Students

Background to the Study

Plagiarism is the act of presenting another person's ideas, words, or work as one's own without proper acknowledgment. In academic settings. It is considered a serious forms of intellectual dishonesty that undermines the core values of scholarship, originality, and integrity, With the rapid growth of the internet, online databases, and artificial intelligence tools, students now have easier access to information, but this has also increased opportunities for plagiarism, whether intentional or unintentional. Therefore, computer science students are particularly involving a lot of code reuse, copying from online forums like Stack Overflow, GitHub repositories, and now AI generated code. The line between legitimate code reuse and plagiarism can be blurry, making awareness and clear perception critical for ethical practice. Though, plagiarism has become a growing concern in higher education, where students, researchers and scholars frequently engage in research, programming, and academic writing. Plagiarism. has turning out to be a big challenge to various researchers and academicians due to the easy readiness of resources anytime from anywhere, which poses a serious threat to the integrity of their work. The prominent reasons considered for the rapid growth in plagiarism cases are lack of awareness about it and its consequences, fierce competition, and easy availability of digital resources online. (Mishra & Gautam, 2017). Plagiarism play a crucial role in determining how they approach academic honesty. While some students may be fully aware of plagiarism and its implications, others may lack proper understanding of what constitutes plagiarism, leading to unintentional violation. In computer science, where assignments often involve coding and collaborative projects, the



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boundary between legitimate collaboration and plagiarism can be blurred, making awareness even more essential. University of Delta, Agbor, a centre of excellence in teaching, learning, research, and community services, emphasises academic excellence and integrity. Yet, the extent to which undergraduate students are aware of plagiarism usage, and how they perceive its seriousness remains a vital area of investigation. Therefore, understanding student's awareness and perceptions of plagiarism usage will help identify gaps in knowledge, attitudes, and practices thereby guiding the university in establishment academic honesty and global recognition among others institutions. However, there is limited empirical data on how aware undergraduate students at University of Delta, Agbor, (UNIDEL), are about plagiarism, and how they perceive its seriousness, causes, and consequences. Understanding their level of awareness and perception is important because it forms the basis for designing effective interventions, library instruction, and departmental policies. It is against this background that this study seeks to examine the awareness and perception of plagiarism use among undergraduate students in UNIDEL, Delta State.

Statement of the Problem

Plagiarism remains a pressing issue in higher education, affecting understanding of academic honesty and the reliability of scholarly work. Despite institutional policies and awareness sensitisation, many students continue to engage in plagiarism, either intentionally or due to unawareness of what constitutes academic dishonesty. Plagiarism is particularly complex because of the frequent use of online resources, open-source materials, and collaborative projects, among undergraduate students which can distortion the line between acceptable academic practices and misconduct. There is limited empirical evidence on how undergraduate students perceive plagiarism usage and the extent of their awareness of its implications. Without such skills, it is difficult for the university to design effective interventions to promote academic morality. If students lack awareness of plagiarism, the institution risks producing ill-prepared graduates to uphold ethical standards in both academia and professional practices. This gaps in understanding forms the basis of the present study.

Objectives of the Study

The main objectives of this study is to assess plagiarism tools: awareness, perception and use among undergraduate students at University of Delta, Agbor, library Delta State. The specific objectives of this study are to:

1. Determine the awareness and perception of undergraduate students towards plagiarism in University of Delta, Agbor
2. Identify the level of UNIDEL undergraduate student's awareness of citation and mostly used citation style; and
3. Identify the types of plagiarism detection software use among undergraduate students of University of Delta, Agbor.

Research Questions

The following research questions are provided in the course of the study and will serve as a guide to the achieve stated objectives

1. What is the levels of awareness and perception of UNIDEL undergraduate students towards plagiarism in University of Delta, Agbor?
2. What is the level of UNIDEL undergraduate student's awareness of citation and mostly used citation style?
3. What are the types of plagiarism detection software use among undergraduate students in University of Delta, Agbor?

Review of Related Literature

Concept of Plagiarism

In general plagiarism can be classified into two broad categories; plagiarism due to refusal to cite sources and plagiarism due to an improper citation (Ma et al., 2008), the former is usually intentional, while the latter is mostly unintentional. Plagiarism if left unchecked could yield graduates and scholars of low standard who could impact on societal development by promoting corruption in public service and tarnishing University's reputation (Gullifer & Tyson, 2010; Marsden et al., 2005). Academic dishonesty, especially plagiarism is a global concern in the academia. Derived from the Latin word *plagiare*; a verb meaning abduct or kidnap (Mangalore, 2006), plagiarism has been defined as an act of reproducing another individual's ideas, document, or any other form of information without acknowledging the source of that information (Hashim et al., no date). According to Douglas Harper, the word originates from *plagiarius* meaning seducer, plunder, or kidnapper (Online Etymology Dictionary 2010).



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Concept of Awareness and Perception of Plagiarism Tools

Awareness according to the Merriam-Webster dictionary is having or showing realization, perception or knowledge of a situation, condition or problem exists. It also refers to the knowledge about an object or event, the competences or skills as well as the methods of operation; it has to do with background knowledge about the object, event or any other phenomenon. (Reinhart, Mletzko, Sloep & Drachsler, 2015). Oyewole, Rasheed and Ogunsina (2018) in their work titled awareness, perception and attitude towards plagiarism by distance learners in University of Ibadan, Nigeria state that it will be difficult for University students to avoid plagiarism if they are not aware of what constitutes plagiarism. The work further revealed that the level of awareness on plagiarism of the distance learner was high. Some studies have also reported an average and low level of plagiarism awareness by university students. One of such is the one conducted by Idiegbeyan-Ose, Nkiko and Osinulu, (2016) that focused on the awareness and perception of plagiarism by postgraduate students in federal, state, and private universities in Ogun State Nigeria. Findings of the study showed that the postgraduate students had an average level of plagiarism awareness. Similarly, Okeke, Oladokun, and Olatunbosun (2025) revealed in their study high awareness and strong use of Turnitin, moderate awareness and use of EagleScan, and comparatively lower engagement with the Third Eye tool. Significant positive relationships were found between awareness and usage of all three tools, showing that students who are more knowledgeable about plagiarism checkers are more likely to apply them in their research. Similarly, Babalola (2012) while studying the awareness and incidence of plagiarism, affirmed a negative attitude towards plagiarism as the majority of the respondents were found to have been involved in different forms of plagiarism. Among the respondents for the study, 69.2% admitted to copying and pasting portions of text from the internet; 65.7% often copied verbatim from a textbook or journal without using quotation marks; 58.5% often included references they did not use in their work and 46.7% submitted assignments without references. Adeniyi and Taiwo (2006) in a similar study involving students in Colleges of Education found out that 476 (34.3%) have copied materials word for word from written source at least once, while 407 (29.3%) have fabricated/falsified. According to Jerome, Christopher and Ifeakachuku (2016) in their findings from the study conducted in selected universities in Ogun state shown average level of awareness of plagiarism among postgraduate students, level of training influenced their level of awareness; pressure to meet deadlines, inadequate writing skills and lack of knowledge of what constitutes plagiarism were found to be responsible for the malaise. Oyewole, and Abioye, (2018) in their study awareness of plagiarism acts and policy postgraduate students in university of Ibadan, Nigeria revealed that most of the respondents 17 (86.4%) were aware of what plagiarism is and majority were highly aware of the different acts that constitutes plagiarism. Results also revealed that a significant proportion of the postgraduate students 110(55.6%) had low level of awareness of existence of a plagiarism policy in their university. Likewise, Sambo, Lawal and Habib (2021) in their study, awareness and perception of plagiarism among postgraduate students of Library and Information Science in South-East University Libraries, Nigeria. The study found that copying and pasting parts of electronic documents without acknowledgement 195(95%), lack of understanding of the concept 187(91%), uses of the materials without references the materials 84%, lack of seriousness on plagiarism 165(80%), improper citation 147(72%), submitting an article downloaded from the internet as assignment 116(57%), plagiarism is not a punishable offence/ it does not deprive the original author of his/ her work 103(50%) and others 97(47%). This is in consonance with the finding of (Gullifer and Tyson, 2010; Marsden et al., 2005), attested that plagiarism if left unchecked could yield graduates and scholars of low standard who could impact on societal. Meanwhile, Perception is the way one think or the ability to understand something using sense organs. It is the process of recognizing, organizing and interpreting sensory information. It deals with the human senses and generate signals from environment through the five sense organs: sight, hearing, touch, smell and taste. (Human Perception and Information Processing, 2015 in Idiegbeyan-Ose, Nikko & Osinulu, 2016). A study carried out by Oyewole, Rasheed and Ogunsina (2018) revealed in their study on the awareness, perception and attitude towards plagiarism by distance learning in university of Ibadan, Nigeria that the respondents have a positive perception of the need to be conscious of plagiarism as an academic crime. The favourable perception could be as a result of their understanding of what plagiarism is. Since they had the knowledge that failure to abide by the ethical principles guiding scholarly writing comes with sanctions, they had to develop a positive perception towards its avoidance.

Awareness of Citation and Most Used Citation

Citation is the practice of acknowledging sources of information, ideas, or data used in academic work. It is a key strategy for avoiding plagiarism and upholding intellectual honesty. Literature shows that proper citation not only gives credit to the original author but also allows readers to verify sources and trace the development of ideas. Despite its importance,



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many undergraduate students lack adequate awareness of why and how to cite sources correctly, leading to unintentional plagiarism (Oyewole & Ogunsina 2018). Students often confuse “citation” with “reference list” and do not understand in-text citation rules. This gap vindicated that awareness does not automatically translate to correct practice. Moreso, Sharaf, and Kadeeja (2021) in their study, Plagiarism: awareness, perception and attitude of research scholars in Farook College, Kozhikode, Kerala, India. The study, revealed that more than half of the researchers (63.52%) prefer MLA style manual for citation which may be due to the ease in structuring and styling guidelines of MLA. It also helps the instructor to read and understand the work without any difficulty, while a few researchers (3.52%) opt for the Chicago style manual for citation. In the same study, by Sharaf, and Kadeeja (2021) the respondents were strongly agreed that APA ($X=3.59$); and MLA ($X=3.48$) are the citation style used, with is greater than the criterion mean score of 2.50, whereas Chicago, Harvard and IEE were citation styles lower than the criterion mean score. The study affirmed that computer science students' undergraduate students used APA and MLA citations styles more than others citations styles.

Awareness and Use of Plagiarism Detection Software

Rangeet (2017) organised a case study on the use of plagiarism detection software at SRTM University. The main objectives of the study were to analyse receipts of theses for plagiarism during the period of study. The findings of the study were those maximum researchers, even though not aware of this process succeeded in testing. Most of them were aware of plagiarism detection tools. Suseela and Uma (2017) examined a study of users' perception at the University of Hyderabad. The main objectives of the study were to examine users' perception regarding plagiarism, to identify plagiarism detection tools, the role of the library in executing new practices in Hyderabad University. The survey result indicated that around 80 percentages of respondents were aware of the concept, functionality features of plagiarism detection tools. 80 to 90 percentages agreed that implementing plagiarism detection tools were satisfied with the information and screening services provided by the library. More so, Sambo, Akanbi, and Shehu, (2021); Sharaf, and Kadeeja (2021), found out that the majority of research scholars (87.05%) are aware of plagiarism detection software. Likewise, the majority of both Arts (87.03%) and Science (87.09 %) researchers are aware of plagiarism detection software.

Plagiarism Detection Software Use

Sharaf Hadejjat (2021) affirmed that out of 29 research scholars using plagiarism detection software, more than half of respondents (62.06%) use Turnitin software for plagiarism detection. (34.48%) tend to use Mendeley software. This may be due to the functionality of Turnitin software, which checks for potentially unoriginal content by comparing submitted papers to several databases using a proprietary algorithm (Turnitin Plagiarism Detection Service Trunk User Guide Trunk User Guide, n.d.). Also, the software mostly used by both Science researchers (62.5%) and Arts researchers (61.53%) is Turnitin. Therefore, plagiarism detection software generally operates by scanning documents and comparing them to a repository of academic journals, websites, and previously submitted student papers. Tools like Turnit, Safe Assign, and iThenticate use string matching and fingerprinting techniques to highlight similarities and generate a similarity index for computer science specifically, tools such as Moss- Measure of Software, similarity developed by Stanford, are designed to detect code plagiarism by analysing programme structure rather than just text. Studies on Nigerian universities show that Turnitin is the most widely adopted plagiarism detection tool, often accessed through institutional subscriptions by libraries. KWASU Malate, like many federal and state universities, provides Turnitin access through the university library to lecturers and postgraduate students for thesis and dissertation screening. However, awareness and access among undergraduate students, especially in computer science, remain low, SafeAssign, integrated into LMS platform like Blackboard, is also used in some institutions, but its database is smaller than Turnitin's. Furthermore, the emergence of plagiarism detection tools has become one of the most prominent institutional responses. These tools compare submitted work against extensive online repositories to identify similarity levels. Manual detection methods are often laborious and impractical, especially when dealing with large volumes of texts (Babalola, 2022), whereas electronic detection offers automated and scalable solutions (Ndebele, 2020). Tools such as Turnitin and other commercial systems have become widely used in higher education to promote academic integrity and deter misconduct (Levine & Pazdernik, 2018). Evidence from several studies shows that plagiarism-checking software can support academic honesty by helping users identify copied text, improve citation practices, and promote originality (Cortes-Vera et al., 2018; Shang, 2019; Heckler et al., 2013)



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Research Methodology

The quantitative component of the research design for this study adopted was in the form of surveys to gather data on the use of plagiarism: awareness, perception and attitude of undergraduate students in UNIDEL. The survey will consist of closed-ended questions aimed at gaining a more comprehensive knowledge of the factors that could impact the awareness and perception of undergraduate students at University of Delta, Agbor. Fowler et al. (2013) define survey design as the systematic process of creating a series. The population of this study consist of 17,000 undergraduate students as at 2025/2026 academic session (Sources: University of Delta, Agbor, Library, Delta State). Therefore, 20% of the total population was chosen for this study. (Kothari, 2004; Gay & Airasian, 2003), viewed that for survey studies, the researcher can use 20% of the population as a representative sample provided the population is large and homogeneous. The instrument deployed for eliciting data from the respondents is a structured questionnaire designed specifically to answer the study questions. The instrument was printed and distributed physically to the respondents. The instrument was made up of four sections with questions very easy to comprehend. Section A comprised the demographic features of the respondents which comprised the respondents' gender. Section B answered questions on awareness and perception of undergraduate student towards plagiarism. Section C is based on awareness of citation and most used citation style. Section D covers the types of plagiarism detection software use among undergraduate students of University of Delta, Agbor. Questions were used in the study for eliciting data since they are easy to design, distribute, and elicit data from a given respondent or group which is necessary to conclude a quantitative study. To determine the level of the questionnaire validity, the researcher elicited the assistance of experienced information professionals who assessed the questionnaire contents made some valid corrections, and confirmed it was appropriate the measure the questions raised in the study. Regarding the instrument reliability, the test and retest method was adopted. Thirty copies of the instrument were distributed to undergraduate students at Ambrose Alli University, Ekpoma, Nigeria, which is situated in Edo State. South-South geopolitical zone of Nigeria. The entire thirty copies were returned and the reliability test was done using Cronbach Alpha Correlation Coefficient at 0.50 acceptance level which yielded $r = 0.82$ as the result. This result indicates that the instrument is reliable since the coefficient result is above the 0.50 benchmark set. The instrument was distributed to the respondents physically at University of Delta, Agbor. The physical distribution of the questionnaire to the respondents ensured the consent of the respondents was sought and their obligations and rights before their inclusion in the study ensuring that ethical standards are upheld. The distribution was carried out with the aid of two research assistants who were adequately briefed by the researcher on how to approach respondents and elicit the necessary data from them to complete the study. Eight hundred and fifty (850) questionnaire were distributed and six hindered and ten (620) were retrieved and valid. The questionnaire distribution and retrieval phase lasted for 2 weeks. The data elicited using the questionnaire was analysed using the descriptive statistics method displayed in tables for clarity.

Presentation of Results

Return Rate

The total sample of the study is six hundred and twenty (620) copies of the questionnaire, which were retrieved and usable. This indicates a 72.9% return rate. The analysis of the collected copies of the questionnaire are presented as follows.

Data Presentation and Analysis

Table 1: Respondents Demographic Information (N=326)

Gender	Frequency	Percentage
Male	398	64.1
Female	222	35.8
Age of respondents		
16-20 years	310	50
21-25 years	190	30.6
26 and above	120	19.3
Total	620	100.0

Field Work Survey, 2026

Table 1 indicates that majority of the respondents 64.1% representing were males while 35.8% were females. This implies that more males participated in the survey. The result above shows that majority of the respondents 50% representing

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(N=310) fall between the ages of 16-20 years, while 30.6% (N=190) fall between ages 21-25 and 19.3% (N= 120) are 26 years and above.

Table 2: Level of Awareness

Awareness Level	VHL	HL	ML	VLL	Weighed Means (X)
I know that submitting AI generated work as my own is plagiarism	355(57.2%)	224(36.1%)	39(6.3%)	2(0.3%)	3.50
I am aware that paraphrasing without proper citation is still plagiarism	320(51.6%)	297(47.9%)	3(3%)	-	3.51
I am aware the difference between common knowledge and ideas that must be cited	186(29.4%)	206(32.2%)	122(19.7%)	106(17.1%)	2.76
I am aware that reusing my own past work is self-plagiarism	292(47.1%)	210(33.9%)	98(6.1%)	20(15.8%)	3.24
I am aware that plagiarism detection software like Turnitin/MOSS etc can detect copied work.	289(46.6%)	178(28.7%)	98(15.8%)	55(8.8%)	3.13
I am aware that copying code from GitHub/Stack Overflow without citations	324(52.2%)	211(34%)	76(12.3%)	9(1.5%)	3.37
I can correctly define plagiarism in my own words	66(10.6%)	245(39.5%)	211(34%)	98(6.1%)	2.5

Field Work Survey, 2026

Aggregate Mean

3.14

Criterion Mean

2.50

As seen from the table 4.2, the grand mean score of 3.14, being greater than the criterion mean score of 2.50, indicates that awareness level of UNIDEL undergraduate students is high. The respondents affirm that paraphrasing without proper citation is still plagiarism (X=3.51), submitting AI generated work as my own is plagiarism (X=3.50), awareness between common knowledge and ideas that must be cited (X=2.76), reusing my own past work is self-plagiarism (X=3.24), awareness on plagiarism detection software like Turnitin/MOSS etc. can detect copied work (X=3.31), awareness on copying code from GitHub/Stack Overflow without citations (X=3.37); and I can correctly define plagiarism in my own words (X=2.5).

Table 3 Perception on Plagiarism

Statements	SA	A	D	SD	Weighed Means (X)
Plagiarism is a serious academic offense	342(49.1%)	278(36.8%)	-	-	3.55
Copying code with a citation is acceptable if the code works	213(37.3%)	134(21.6%)	106(17.1%)	167(27%)	2.63
Using AI tools like ChatGPT to write assignments is not plagiarism if I edit it	200(32.3%)	198(31.9%)	117(18.9%)	105(16.9%)	2.79
Paraphrasing someone's idea without proper citation is wrong	111(17.9%)	312(50.3%)	175(28.2%)	22(3.5%)	2.82
Plagiarism reduces the quality and originality of academic work	236(38.1%)	234(37.7%)	98(15.8%)	52(8.4%)	3.05

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Field Work Survey, 2026

Aggregate Mean

2.97

Criterion Mean

2.50

Table 3, indicate that the grand mean score of 2.97, being greater than the criterion mean score of 2.50, indicates that awareness level of undergraduate students of UNIDEL is high. The respondents affirm that plagiarism is a serious academic offense (X=3.55), plagiarism reduces the quality and originality of academic work (X=3.05), paraphrase someone idea without proper citation is wrong (X=2.82), using AI tools like ChatGPT to write assignments is not plagiarism if edited (X=2.79); and copy code with a citation is acceptable (X=2.63),

Table 4: Awareness of Citation and Most Used Citation

Awareness of Citations	SA	A	D	SD	Weighed Mean (X)
I am aware of APA citation style	435(70.1%)	185(29.8%)	-	-	3.70
I am aware of MLA citation style	256(41.2%)	201(33.8%)	63(10.2%)	100(16.1%)	2.99
I am aware of Chicago citation style	177(28.5%)	122(19.7%)	120(19.4%)	201(32.4%)	2.44
I am aware of Harvard citation style	100(16.1%)	90(14.5%)	245(39.5%)	185(29.8%)	2.16
I am aware of IEEE citation style	76(12.3%)	98(15.8%)	230(37.1%)	216(34.8%)	2.05
Citations Style Used					Aggregate Mean 2.67
					Criterion Mean 2.50
MLA	245(39.5%)	277(44.6%)	75(12.1%)	23(3.7%)	2.92
APA	321(61.3%)	299(30%)	-	-	3.51
Chicago	154(14.1%)	100(24.8%)	264(29.8%)	102(31.2%)	2.5
Harvard	111(5.5%)	147(14.1%)	212(34.4%)	150(46%)	2.35
IEEE	109(3%)	123(5.6%)	176(54%)	212(34.4%)	2.20

Field Work Survey, 2026

Aggregate Mean

2.70

Criterion Mean

2.50

Table 4, indicate that the grand mean score of 2.70, being greater than the criterion mean score of 2.50, indicates that UNIDEL undergraduate student's awareness of citation is high. The respondents strongly agreed that they were aware of APA citation style (X=3.70), MLA citation (X=2.99). Although, IEE citation style (X=2.05), Chicago citation (X=2.44), and Harvard citation style (X=2.16), were below the criterion mean score of 2.50. APA citation style and MLA were the most used citation styles among others.

Table 5: Types of Plagiarism Detection Software Use

Plagiarism Detection Software Used	SA	A	D	SD	Weighed Means (X)
Turnitin	213(34.4%)	245(39.5%)	39(6.3%)	123(19.8%)	2.88
Grammarly premium	321(51.8%)	299(48.2%)	-	-	3.52
iThenticate	189(30.5%)	279(45%)	100(16.1%)	52(8.4%)	2.98
Ouriginal/Urkund	177(28.5%)	258(41.6%)	78(12.6%)	107(17.3%)	2.81
Plagscan	258(41.6%)	267(43.1%)	95(15.3%)	-	3.26
Quetext	286(46.1%)	200(32.3%)	34(5.5%)	100(16.1%)	3.08

Field Work Survey, 2026

Aggregate Mean

3.08

Criterion Mean

2.50

Table 4.5, indicate that the grand mean score of 3.08, being greater than the criterion mean score of 2.50, shows that UNIDEL undergraduate student's used of plagiarism software is high. The respondents strongly agreed that grammarly



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premium, (X=3.52), plagscan (X=3.26), quetext (X=3.08), iThentcate (X=2.98), Turnitin (X=2.88), and Ouriginal/Urkund (X=2.81) were the typed of plagiarism detection software used by the UNIDEL undergraduate students.

Discussion of the Findings

The result generated from the findings revealed that computer science undergraduate student's awareness and perception on plagiarism is high. The majority of the respondents were strongly agreed that paraphrasing without proper citation is still plagiarism, I know that submitting AI generated work as my own is plagiarism, I am aware the difference between common knowledge and ideas that must be cited, I am aware that reusing my own past work is self-plagiarism, I am aware that plagiarism detection software like Turnitin/MOSS etc. can detect copied work/ I am aware that copying code from GitHub/Stack Overflow without citations and I can correctly define plagiarism in my own words. This is in line with the finding of Oyewole, Rasheed and Ogunsina (2018) opined that the respondents have a positive perception of the need to be conscious of plagiarism as an academic crime. Findings also indicate that majority of UNIDEL undergraduate students level of perception is high. They believed that paraphrasing without proper citation is still plagiarism, copying code with a citation is acceptable if the code works, plagiarism is a serious academic offense, using AI tools like ChatGPT to write assignments is not plagiarism if I edit; and paraphrasing someone's idea without citation is till wrong. This is supported with the finding of Babalola (2012); Okeke, Oladokun, and Olatunbosun (2025). In their study, majority of the respondent's affirmed that awareness and perception does not influence attitude towards plagiarism as the majority of the respondents were found to have been involved in different forms of plagiarism. Findings further showed that UNIDEL undergraduate students awareness and use of citation is high. The respondents strongly agreed that they were aware of APA citation style, MLA citation. IEE citation style, Harvard citation style and Chicago citation style. Although the most used citation styles are APA and MLA citation styles among others. This is in consonance with the findings of Sharaf, and Kadeeja (2021), who affirmed that the respondents were strongly agreed that APA, and MLA are the citation style used, with is greater than the criterion mean while Chicago, Harvard and IEE were citation styles lower than the criterion mean score. Finally, the study indicated that UNIDEL undergraduate students strongly agreed that Grammarly Premium, Plagscan, Quetext, Turnitin, iThentcate, and Ouriginal/Urkund were the typed of plagiarism detection software used by the UNIDEL undergraduate students. This is supported by the finding of Suseela and Uma (2017) in their study, indicated that majority of the respondents were aware of plagiarism detection tools, and uses.

Conclusion

In conclusion, the results of this study have showed that majority of UNIDEL undergraduate students level of plagiarism awareness and perception. are high. Even though there have been many efforts that have been initiated to curb plagiarism in Nigeria Universities such as Turnitin, copycatch, plagium, Eve2, see sources, plagiarism Detect, or plagiarism checker and Essay Rater these initiatives are commendable step to reducing plagiarism activities among students, researchers and scholars in the university. Students need to be sensitized on plagiarism tools, awareness, perception and the use.

Recommendations

Based on findings and discussions with relevant conclusion, the following recommendations are made.

1. The University should adopt well publicised institutional policies that clearly define plagiarism behaviours and their consequences and more awareness should be inculcated through introduction of the concept of plagiarism into curriculum order to avoid abuse of intellectual property.
2. Management should introduce use of citation into teach curriculum to avoid unnecessary plagiarism.
3. More awareness should be inculcated on different typed of plagiarism detection software to the students in the university order to avoid abuse of intellectual property

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Impacts of Computer-Based Learning Strategy on Skill Acquisition and Academic performance in Computer Science among Senior Secondary School Students in Zamfara State, Nigeria

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Abstract

This study investigated the impact of Computer-Based Learning (CBL) on skill acquisition and academic performance in Computer Science among selected public senior secondary school students in Zamfara State, Nigeria. A non-equivalent pre-test/post-test control group quasi-experimental design was adopted, with a sample of 108 valid SS II cases comprising an experimental group (n=71) exposed to Computer-Based Learning and a control group (n=37) taught using conventional instructional methods. Data were collected using two validated instruments: the Computer-Based Skills Acquisition Test (CBSAT) and the Academic Performance Test (APT). Descriptive statistics (mean and standard deviation) were used to answer the research questions, while Analysis of Covariance (ANCOVA) was employed to test the two null hypotheses at a .05 level of significance, using pre-test scores as covariates. The findings revealed that Computer-Based Learning had a statistically significant positive effect on both practical skills acquisition ($F(1,105)=23209.901, p<.001, \eta^2=.995$) and academic performance ($F(1,105)=7434.087, p<.001, \eta^2=.986$). Students taught using CBL achieved significantly higher adjusted post-test mean scores than those in the conventional group. Based on these findings, it was concluded that CBL is a highly effective pedagogical tool for enhancing cognitive performance and digital practical skills in Computer Science. It was recommended, among others, that educational stakeholders in Zamfara State institutionalize computer-based learning packages and prioritize the provision of functional ICT infrastructure and regular teacher capacity-building workshops across public secondary schools.

Keywords: Computer-Based Learning, Skills Acquisition, Academic Performance, Computer Science, Zamfara State.

Introduction

The increasing influence of digital technology on education has created new opportunities for improving teaching, learning and the development of relevant competencies among secondary school students. In contemporary education, learners are expected not only to acquire theoretical knowledge but also to develop practical, digital, problem-solving and other transferable skills needed for further education and participation in the modern economy (Bawa, 2015). Computer-Based Learning (CBL) has therefore emerged as an important instructional approach through which computer applications, multimedia resources, interactive learning materials, simulations and digital assessment tools are integrated into the teaching and learning process (Ene, 2022). By providing opportunities for interaction, repeated practice, immediate feedback and self-paced learning, CBL has the potential to make learning more active and meaningful and to improve students' academic outcomes (Bawa, 2015). In the Nigerian educational context, the relevance of CBL is particularly important because of the growing demand for learners who possess both academic knowledge and practical competencies. Senior secondary education represents an important stage for developing students' cognitive, practical and digital skills



Impacts of Computer-Based Learning Strategy on Skills Acquisition and Academic Performance in ... Usman, A., Et. al., (2026) before they proceed to higher education, vocational training or the world of work (Gambari et'al, 2015). Consequently, instructional approaches that move beyond passive reception of information and provide students with opportunities to interact with learning content and practise skills are increasingly important (Bawa, 2015). CBL can support this process by presenting instructional materials through text, graphics, audio, video, animation and interactive activities. Its effectiveness, however, depends on the availability of appropriate facilities, teachers' capacity to integrate technology pedagogically and students' access to functional digital learning environments (Mujitapha, 2026). Empirical studies conducted in Nigeria have provided evidence of the potential of computer-based instructional approaches to improve students' academic performance. Gambari, et'al, (2015) investigated computer-assisted cooperative learning strategies among secondary school students in Physics in Minna, Nigeria. Their quasi-experimental study found that students exposed to computer-assisted cooperative learning strategies achieved significantly better results than those taught through individualized computer instruction. The finding suggests that the educational value of computer technology may be enhanced when it is integrated with appropriate instructional strategies that promote interaction and active participation. Similarly, Okwuoza and Olajumoke (2023) examined the effect of a Computer-Assisted Instructional (CAI) package on the achievement of senior secondary school students in Mathematics in Nigeria. Using a quasi-experimental design involving 178 SS II students, the study provided empirical evidence on the use of CAI as an alternative to conventional instructional practices. The study is relevant to the present research because it demonstrates the continuing interest in examining whether computer-supported instruction can improve learning outcomes among Nigerian secondary school students. Evidence from northern Nigeria also demonstrates the relevance of technology-supported instruction to secondary school learning. Bawa (2015) investigated the effects of computer-based instructional materials on students' academic performance in Computer Science in Kebbi State. The study adopted a quasi-experimental pre-test and post-test design and compared students exposed to computer-based instructional materials with those taught through conventional approaches. The study provides a useful empirical basis for examining the relationship between computer-supported learning and academic performance in a context geographically and socio-educationally related to Zamfara State. Therefore, evidence from Nigerian empirical studies, suggests that computer-supported instruction can contribute to improved academic achievement, computer literacy and the development of relevant learning competencies. Nevertheless, the findings also indicate that the effectiveness of computer-based approaches is not automatic. The nature of the instructional strategy, the quality of the digital content, the availability of facilities, teacher competence and the context of implementation can influence the outcomes of CBL. Gambari et al. (2015) demonstrated that the way computer technology is combined with cooperative learning can affect students' achievement outcomes, while studies on computer-assisted instruction and computer literacy show that technology can support skills development when it is deliberately integrated into the instructional process.

Statement of the problem

Despite the growing body of Nigerian research on computer-assisted instruction, e-learning and other forms of educational technology, there remains a need for more context-specific evidence concerning the combined influence of CBL on both skills acquisition and academic performance among students in public senior secondary schools in Zamfara State. Much of the existing evidence has focused on specific subjects, particular instructional packages or other states of the federation. Consequently, findings from other contexts cannot be assumed to apply directly to public senior secondary schools in Zamfara State, where differences in infrastructure, teacher preparedness, access to computers, electricity supply and students' exposure to digital learning may affect the effectiveness of CBL. The need for the present study is further strengthened by the increasing emphasis on preparing Nigerian students with practical and digital competencies alongside academic knowledge. If CBL is effectively designed and implemented, it may provide students with opportunities to engage actively with learning materials, practice skills, receive immediate feedback and improve their understanding of difficult concepts. However, the extent to which these potential benefits are realized among students in selected public senior secondary schools in Zamfara State requires empirical investigation. It is against this background that this study examines the impact of Computer-Based Learning on skills acquisition and academic performance among students in selected public senior secondary schools in Zamfara State, Nigeria.

Research Objectives

The study seeks to:



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1. Determine the difference in skills acquisition between students taught using Computer-Based Learning (CBL) and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State.
2. Examine the difference in academic performance between students taught using Computer-Based Learning (CBL) and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State.

Research Questions

1. What is the difference in the mean skills acquisition scores of students taught using Computer-Based Learning and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State?
2. What is the difference in the mean academic performance scores of students taught using Computer-Based Learning and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State?

Research Hypotheses

The following null hypotheses were formulated and tested at the \$.05\$ level of significance:

- H0₁: There is no significant difference in the mean skills acquisition scores of students taught Computer Science using Computer-Based Learning and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State.
- H0₂: There is no significant difference in the mean academic performance scores of students taught Computer Science using Computer-Based Learning and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State.

Research methodology

This study employed a quasi-experimental research design (non-randomized, non-equivalent, pretest, posttest control group design). The design measures the impact of Computer-based learning, as the treatment for independent variables on skills acquisition and student academic performance served as the dependent variables. Two (2) groups of subjects were randomly assigned using an intact class in order to investigate the effects on pre-test and posttest. Computer based learning (CBL) serves as treatment to the experimental group, while the Control Group was without treatment. Pretest was administered to the two groups, in order to ascertain the skills acquisition and technical students' academic differences in term of performance level and preparedness. The tool employed was an instructional lesson plan which covers sub-topics of SS two computer science scheme of work. The target population of the study consisted of 227 senior secondary school two students in public technical secondary schools in Zamfara state. A sample of 108 students were selected from the population using a multistage sampling procedure. First, two (2) public technical senior secondary schools was identified through purposive sampling based on the availability of basic facilities required for the study, particularly computer facilities and suitable classrooms. Second, intact classes were selected from the participating schools. The selected classes was assigned to either the experimental or control group. The experimental group received instruction using Computer-Based Learning, while the control group received instruction using conventional teaching methods. The instruments employed for the study, were Computer-Based Skills Acquisition Test (CBSAT) and Academic Performance Test (APT). The Computer-Based Skills Acquisition Test (CBSAT) was developed to measure students' acquisition of relevant skills after exposure to the CBL treatment. The test will be based on the specific skills and learning objectives contained in the selected curriculum content. The Academic Performance Test (APT) was used to measure students' academic achievement in the selected subject or content area. The test items will be developed based on the relevant senior secondary school curriculum and the topics covered during the treatment period. However, the use of separate instruments for skills acquisition and academic performance is justified because the two variables represent related but distinct learning outcomes. While academic performance may reflect students' mastery of subject knowledge, skills acquisition focuses more directly on the ability to apply knowledge and demonstrate practical competencies. The research instruments were submitted to experts in Educational Technology, Measurement and Evaluation, and the relevant subject area for validation. The experts examined the instruments in terms of content coverage, clarity of items, relevance to the research objectives and appropriateness of the items for the target students. Their observations and recommendations was used to modify and improve the instruments before the final administration. The reliability of the instruments were established through a pilot test involving students who are similar to the participants of the study but not included in the main study. A correlation coefficient of 0.86 index score was obtained which was considered high and suitable for gathering data. The instruments were certified to have face and content validity by experts.



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To validate and authenticate the lesson plan, it was giving to three experts, the expert rating scales for the tools on the appropriateness of the lesson plan, out of 100 points, were 85%, 88% and 90% and the mean rating was 87.7% representing the content, consensus or logical validity of the lesson plan. The students received the treatment of Computer Achievement test by the students' regular Computer science teacher using researcher prepared lesson plan. The training for computer science teachers lasted for one week in the sampled schools. The control group received no treatment but all of them were taught computer science by their computer class teacher using researcher prepared lesson plan to make for uniformity in the presentation of the lessons in the experimental and control group classes. Data collected were subjected to descriptive and inferential statistics. Descriptive statistics such as mean and standard deviation were used to answer the research questions while inferential statistics such as student t-test was used to test the hypotheses. Hypotheses were tested at 0.05 level of significant using Statistical Package for Social Science (SPSS) version 21.0.

Experimental Procedure

The study was conducted in the following stages:

Stage One: Preparation: The researcher obtained permission from the relevant educational authorities and school administrators. The participated teachers were briefed on the purpose and procedures of the study. The instructional materials and CBL resources was also prepared.

Stage Two: Pre-test: The Skills Acquisition Test and Academic Performance Test were administered to both the experimental and control groups before the treatment. The pre-test was established the students' baseline levels of skills acquisition and academic performance.

Stage Three: Treatment: The experimental group was taught base on selected instructional content using Computer-Based Learning such as multimedia presentations, computer simulations, interactive learning activities, instructional videos, computer-based exercises, digital demonstrations, immediate feedback; and computer-assisted assessment activities while the control group were taught the same instructional content using conventional teaching methods, such as teacher explanation, discussion, textbook use and board-based instruction.

Stage Four: Post-test: At the end of the treatment period, the same or equivalent versions of the research instruments were administered to both groups. The post-test results was compared with the pre-test results to determine the impact of CBL on students' skills acquisition and academic performance.

Presentation of Results

Research Question One: *What is the difference in the mean skills acquisition scores of students taught Computer Science using Computer-Based Learning and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State?*

Table 1: Descriptive Statistics for Post-Test Skills Acquisition Scores (CBSAT)

Group	N	Post-Test Mean	Standard Deviation	Mean Difference
Experimental (CBL)	71	74.789	6.500	23.275
Control (Conventional)	37	51.514	6.518	
Total	108	66.815	12.849	

The descriptive results presented in Table 1 reveal that the experimental group, consisting of 71 students instructed using Computer-Based Learning (CBL), achieved a post-test mean score of 74.789 with a standard deviation of 6.500 on the Computer-Based Skills Acquisition Test. Conversely, the control group, comprising 37 students taught using conventional instructional methods, recorded a post-test mean score of 51.514 with a standard deviation of 6.518. The resulting mean difference of 23.275 points in favor of the experimental group indicates that students exposed to computer-based instructional materials demonstrated higher levels of practical skill acquisition than those exposed to conventional teaching methods.

Hypothesis 1 (H₀₁): *There is no significant difference in the mean skills acquisition scores of students taught Computer Science using Computer-Based Learning and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State.*

Table 2: ANCOVA Summary Table for Post-Test Skills Acquisition Scores

Source	Type III Sum of Squares	df	Mean Square	F-value	Sig. (p)	Partial Squared (η ²)	Eta Decision
Corrected Model	17613.182	2	8806.591	18090.793	.000	.997	



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Intercept	821.553	1	821.553	1687.662	.000	.941	
Pre_CBSAT	4435.960	1	4435.960	9112.497	.000	.989	
(Covariate)							
Group (Main Effect)	11298.571	1	11298.571	23209.901	.000	.995	Reject HO
Error	51.114	105	0.487				
Total	499800.000	108					
Corrected Total	17664.296	107					

Note: R Squared = .997 (Adjusted R Squared = .997). Covariate evaluated at Pre_CBSAT baseline mean = 32.519. Adjusted Grand Mean = 63.399.

The univariate ANCOVA results in Table 2 demonstrate that after controlling for entry-level performance using the pre-test covariate pre-test, the main effect of the instructional strategy (Group) yielded an F-calculated value of $F(1,105)=23209.901$ with a significance value of $p=.000$. Because the probability value is less than the .05 level of significance ($p<.05$), Null Hypothesis 1 is rejected. This confirms a statistically significant difference in the mean skills acquisition scores between students taught Computer Science using Computer-Based Learning and those taught using conventional instructional methods. Furthermore, the partial eta squared index ($\eta^2=.995$) shows an extremely high effect size, indicating that 99.5% of the total variance in practical skills acquisition is directly explained by exposure to Computer-Based Learning.

Research Question Two: *What is the difference in the mean academic performance scores of students taught Computer Science using Computer-Based Learning and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State*

Table 3: Descriptive Statistics for Post-Test Academic Performance Scores (APT)

Group	N	Post-Test Mean	Standard Deviation	Mean Difference
Experimental (CBL)	71	72.324	6.251	18.216
Control (Conventional)	37	54.108	6.315	
Total	108	66.083	10.696	

The descriptive data contained in Table 3 show that the experimental group ($N=71$) achieved a post-test academic performance mean score of 72.324 with a standard deviation of 6.251 on the Academic Performance Test. On the other hand, the control group ($N=37$) recorded a post-test mean score of 54.108 with a standard deviation of 6.315. The resulting mean difference of 18.216 points demonstrates that students taught Computer Science via Computer-Based Learning attained higher cognitive academic outcomes than their counterparts in the conventional instructional group.

Hypothesis 2 (H0₂): *There is no significant difference in the mean academic performance scores of students taught Computer Science using Computer-Based Learning and those taught using conventional instructional methods in selected public senior secondary schools in Zamfara State.*

Table 4: ANCOVA Summary Table for Post-Test Academic Performance Scores

Source	Type III Sum of Squares	df	Mean Square	F-value	Sig. (p)	Partial Eta Squared (η^2)	Decision
Corrected Model	12148.881	2	6074.441	6831.147	.000	.992	
Intercept	438.581	1	438.581	493.216	.000	.824	
Pre_APT	4077.748	1	4077.748	4585.722	.000	.978	
(Covariate)							
Group (Main Effect)	6610.591	1	6610.591	7434.087	.000	.986	Reject HO
Error	93.369	105	0.889				
Total	483879.000	108					
Corrected Total	12242.250	107					

Note: R Squared = .992 (Adjusted R Squared = .992). Covariate evaluated at baseline mean = 36.481. Adjusted Grand Mean = 63.469.



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The inferential results displayed in Table 4 indicate that after adjusting for initial pre-test entry levels using pre-test as a covariate, the main effect of group treatment produced an F-calculated value of $F(1,105)=7434.087$ with an associated p-value of .000. Because the p-value is less than the standard threshold of .05 ($p<.05$), Null Hypothesis 2 is rejected. The decision confirms that a statistically significant difference exists in the academic performance scores of students exposed to Computer-Based Learning compared to those taught using traditional methods. Additionally, the partial eta squared value ($\eta^2=.986$) reveals that 98.6% of the variance in students' cognitive academic achievement is accounted for by the Computer-Based Learning treatment.

Discussion of Findings

The findings of this study revealed that exposure to Computer-Based Learning (CBL) resulted in a statistically significant improvement in senior secondary school students' practical skills acquisition in Computer Science when compared to the conventional instructional approach. The experimental group achieved a post-test mean score of 74.789 (SD = 6.500), whereas the control group recorded a mean score of 51.514 (SD = 6.518). This substantial mean difference of 23.275 points demonstrates that integrating digital technology, interactive simulations, and structured practical exercises into instruction significantly strengthens practical competency development. This result aligns directly with the contextual perspective established by Ene (2022), who emphasized that CBL enhances meaningful learning through active engagement, self-paced practice, and immediate corrective feedback. In contemporary education, senior secondary school learners are required to go beyond passive memorization to cultivate practical digital problem-solving skills needed for the modern economy (Bawa, 2015). The findings demonstrate that computer-supported environments provide the interactive framework necessary for students to manipulate software, perform guided digital tasks, and master practical competencies more effectively than traditional chalk-and-talk methods. Furthermore, the high level of skill acquisition observed among students in Zamfara State supports the empirical observations of Mujitapha (2026), who posited that the educational impact of technology depends heavily on providing functional digital learning environments that allow deliberate practice. When students are granted direct interaction with computer-based learning applications, their ability to transfer abstract theoretical concepts into executable practical skills is heightened. Regarding cognitive academic outcomes, the inferential analysis demonstrated a statistically significant difference in favor of students taught using Computer-Based Learning. Students in the experimental group achieved a post-test performance mean of 72.324 (SD = 6.251), outperforming their counterparts in the control group who recorded a post-test mean of 54.108 (SD = 6.315). The resulting mean difference of 18.216 points provides clear empirical evidence that computer-supported instructional packages foster greater cognitive retention and conceptual understanding in Computer Science. This outcome strongly echoes the empirical findings of Bawa (2015), who investigated computer-based instructional materials in Computer Science within Kebbi State a region geographically and socio-educationally similar to Zamfara State. Bawa (2015) established that technology-supported instruction significantly boosts academic performance compared to conventional teaching methods. The convergence of these results confirms that deliberate technology integration yields reliable educational gains across secondary schools in Northern Nigeria. The results are also consistent with the work of Okwuoza and Olajumoke (2023), who established the superiority of Computer-Assisted Instruction (CAI) over conventional teaching methods among Nigerian secondary school students. Similarly, Gambari et al. (2015) demonstrated that computer-supported strategies enrich instructional delivery by turning passive learners into active participants through visual, auditory, and practical engagement. The current study reinforces this consensus: combining multimedia elements (text, graphics, animations, and interactive tasks) lowers cognitive load, increases student motivation, and drives superior academic achievement.

Conclusion

Based on the empirical findings of this study, it is concluded that Computer-Based Learning (CBL) is a far more effective instructional strategy than the conventional teaching method for enhancing senior secondary school students' learning outcomes in Computer Science in Zamfara State. Specifically, the integration of interactive digital materials, practical simulations, and computer-supported learning environments significantly improves students' practical skills acquisition and boosts their overall academic performance. Controlling for pre-test baseline scores revealed that the massive gains in both practical competencies and cognitive achievement were directly attributable to exposure to Computer-Based Learning. Transitioning from traditional, teacher-centered instruction toward technology-supported, active-learning environments addresses the growing demand for secondary school graduates who possess both theoretical understanding and actionable digital competencies needed for higher education and the modern global economy.



Recommendations

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

1. Educational stakeholders and the Ministry of Education in Zamfara State should formally integrate Computer-Based Learning (CBL) packages and software into the senior secondary school Computer Science curriculum to replace or complement traditional lecture-based methods.
2. State government authorities, school administrators, and private partners should prioritize the equipping of public senior secondary schools with functional computer laboratories, reliable power supply, internet connectivity, and up-to-date educational software to create conducive digital learning environments.
3. Ministry officials and school boards should organize regular workshops, seminars, and hands-on professional development programs for Computer Science teachers. This will enhance their pedagogical skills in designing, operating, and integrating computer-based instructional materials into everyday classroom instruction.
4. Curriculum planners (such as NERDC) should structure the secondary school Computer Science curriculum to place greater emphasis on interactive, practical-oriented digital activities, encouraging self-paced learning and immediate feedback mechanisms for students.
5. Policy-makers should allocate dedicated budgetary provisions for digital technology infrastructure in secondary education to bridge the digital divide between rural and urban public schools in Northern Nigeria.

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Influence of Curriculum Adaptation on Effective Implementation of Physical Education Programs in Nigeria's Special Schools

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Abstract

This study investigated curriculum adaptation as a determinant of effective implementation of Physical Education (PE) programmes in Nigeria's special schools. A survey research design was adopted. The study population consisted of 1,177 special schools in Nigeria, comprising 2,354 administrators and 1,177 Physical Education teachers. Using multi-stage sampling, 390 respondents were selected. Data were collected through a validated, self-developed questionnaire with a high internal consistency (Cronbach's alpha = 0.824). Chi-square (χ^2) statistics was used to test the hypothesis at a 0.05 level of significance. The results revealed that curriculum adaptation significantly determines the effective implementation of PE programmes in Nigeria's special schools ($\chi^2 = 119.13$, $df = 27$, $p = 0.000$). The study concludes that curriculum adaptation is a critical driver of successful PE implementation, enhancing inclusivity, motor skill acquisition, and psychosocial learning outcomes among students with disabilities. It is recommended that the Federal and State Ministries of Education redesign adaptive PE curricula, mandate continuous professional development for teachers on inclusive instructional strategies, and allocate dedicated funding for adaptive sports equipment.

Keywords: Curriculum adaptation, Adapted Physical Education (APE), Special schools, Programme implementation,

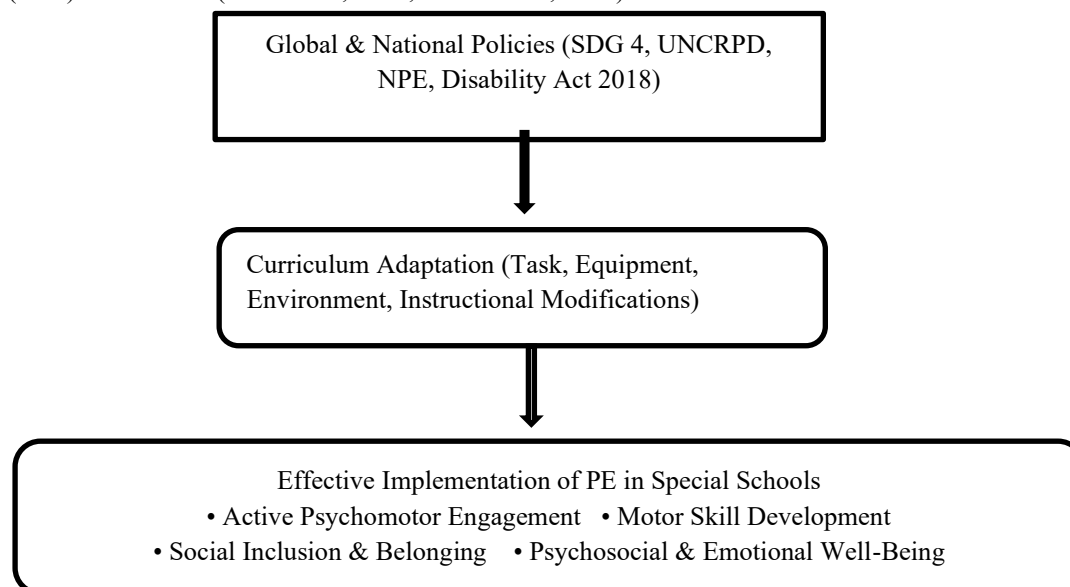
Introduction

Education is universally recognized as a fundamental human right, a catalyst for socio-economic development, and a key mechanism for promoting equity and social inclusion. Global policy frameworks, most notably Sustainable Development Goal 4 (SDG 4) of the United Nations 2030 Agenda, explicitly mandate member states to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (UNESCO, 2020). Despite this global mandate, learners with disabilities across developing nations, particularly in Sub-Saharan Africa, continue to face deep structural inequities in accessing quality physical and health education (UNESCO, 2021). Physical Education (PE) plays an indispensable role in holistic child development. It is unique within the educational curriculum as it simultaneously addresses the psychomotor, cognitive, and affective domains of learning (World Health Organization [WHO], 2020). For learners with special educational needs and disabilities (SEND) including individuals with visual impairments, hearing impairments, physical disabilities, intellectual impairments, and neurodevelopmental conditions—regular participation in physical activity is vital. It improves cardiovascular health, enhances functional motor skills, reduces secondary health conditions, builds self-efficacy, and fosters social integration (Block, 2016; Haegele & Sutherland, 2015; Lieberman et al., 2020). However, realizing these benefits depends fundamentally on how the curriculum is designed, modified, and delivered. When a rigid, one-size-fits-all PE curriculum designed primarily for neurotypical and able-bodied learners is imposed in special education settings, students with disabilities are systematically marginalized. Curriculum adaptation—the process of modifying instructional objectives, task complexities, environmental settings, equipment, and assessment strategies to match the unique functional capabilities of each learner—serves as the bridge between theoretical inclusion and meaningful pedagogical practice (Sherrill, 2004; Winnick & Porretta, 2017). In Nigeria, the legal and policy foundation for inclusive education is anchored in the National Policy on Education (Federal Ministry of Education [FME], 2013), which emphasizes equal educational opportunities for all children irrespective of physical, sensory, or cognitive challenges. Furthermore, the passage of the Discrimination Against Persons with Disabilities (Prohibition) Act of 2018 formally institutionalized the right of persons with disabilities to accessible education, public infrastructure, and recreational facilities. At the international level, Nigeria is a signatory to the United Nations Convention on the Rights of Persons with



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Disabilities (UNCRPD, 2006), Article 30 of which specifically mandates state parties to ensure that children with disabilities have equal access to participation in play, recreation, leisure and sports activities within the school system. Despite these legislative instruments, the implementation of Physical Education in Nigeria's special schools remains severely compromised. Historical analyses reveal that physical education in Nigerian schools has predominantly catered to able-bodied students, utilizing standardized sports rules, conventional facilities, and rigid physical fitness measures (Adewumi & Mosaku, 2019; Amusa & Toriola, 2018). In special schools across the six geopolitical zones of Nigeria, PE instruction often degrades into unstructured free play or passive observation due to the absence of formal Adapted Physical Education (APE) frameworks (Abah et al., 2022; Eze & Anih, 2015).



Curriculum adaptation operates within the theoretical framework of Bronfenbrenner's Ecological Systems Theory and Self-Determination Theory (Deci & Ryan, 2000). According to these frameworks, human development and intrinsic motivation are heavily influenced by the interaction between the individual's micro-environment (the school/gymnasium) and the structural support systems provided (adaptive tools, teacher competence and modified tasks). When task demands exceed a learner's functional ability without appropriate adaptations, frustration, withdrawal, and task avoidance follow. Conversely, when task parameters are adapted (e.g., utilizing sound-emitting balls for visually impaired students, lower basket heights for wheelchair users, or simplified task cues for intellectually challenged learners), students experience enhanced competence, autonomy, and engagement (Lieberman et al., 2020; Rose & Ring, 2016).

Systemic barriers to effective PE implementation in Nigeria's special schools include:

1. **Teacher Competence and Pre-Service Preparation:** A significant proportion of PE teachers deployed to special schools are trained in general physical education and lack specialized skills in Adapted Physical Education (APE) pedagogy (Okafor & Adeyemi, 2019; Yusuf & Ibrahim, 2021).
2. **Resource Constraints and Adaptive Equipment:** Most special schools suffer from a chronic deficit of specialized adaptive sports equipment (e.g., bell balls, guide runners, modified racquets, ramp systems) and accessible physical environments (Adewumi, 2015; World Health Organization, 2021).
3. **Rigid Curriculum Structure:** The centralized national curriculum guidelines often lack explicit modules on task modification strategies, leaving teachers without clear protocols to differentiate instruction for diverse disability categories (Ajayi, 2017; Ajobiwe, 2018).

While empirical studies have examined general barriers to inclusive education in Nigeria (Adewumi & Mosaku, 2019; Ajobiwe, 2018), there remains an empirical gap regarding how curriculum adaptation specifically acts as a primary determinant of overall PE programme implementation across special schools nationwide. This study addresses this gap by investigating the extent to which curriculum adaptation determines the effective implementation of Physical Education programmes in Nigeria's special schools.

Objective of the Study



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The primary objective of this study was to determine the extent to which curriculum adaptation influences the effective implementation of Physical Education programmes in Nigeria's special schools.

Research Hypothesis

To guide the investigation, the following null hypothesis was tested at the 0.05 level of significance:

H₀₁: Curriculum adaptation does not significantly determine the effective implementation of Physical Education programmes in Nigeria's special schools.

Research Methodology

Research Design

A survey research design was adopted for this study. This design allows for the systematic collection of quantitative data from a representative sample across a wide geographical spread, making it suitable for assessing institutional practices, administrative perspectives and instructional implementation patterns across Nigeria's educational zones (Ali, 2021; Creswell & Creswell, 2018).

Population and Sample

The target population comprised all public and accredited private special schools across the six geopolitical zones of Nigeria. According to institutional records from the National Commission for Special Education and disability administrative registers, the study population consisted of 1,177 special schools, encompassing 2,354 school administrators (principals/headteachers and vice-principals) and 1,177 Physical Education teachers (Disability Rights Commission, 2024). Using Adams' (2020) formula for sample size determination in large populations, a total sample of 390 respondents (comprising 260 administrators and 130 PE teachers) was selected. A multi-stage sampling procedure was executed as follows: Stratified Sampling: The country was stratified into the six geopolitical zones (North-West, North-East, North-Central, South-West, South-East, and South-South); Simple Random Sampling: Two states were selected at random from each geopolitical zone (12 states total, plus the Federal Capital Territory, Abuja); Purposive Sampling: Special schools catering to visual, auditory, physical, and intellectual impairments were selected within each state to ensure representation across major disability categories and Proportional Sampling: Administrators and PE teachers were selected from the sampled institutions.

Instrument for Data Collection

Data were gathered using a structured, researcher-developed instrument titled the "*Determinants of Effective Implementation of Physical Education Programme Questionnaire*" (DEIPEQ). The instrument was divided into two main sections: Section A: Demographic variables of respondents (institutional designation, professional qualification, years of teaching/administrative experience, visual/physical status); Section B: 28 items measuring dimensions of curriculum adaptation (content modification, equipment adaptation, pedagogical variation, environmental restructuring, and assessment adjustments) rated on a 4-point Likert scale (*Strongly Agree* = 4, *Agree* = 3, *Disagree* = 2, *Strongly Disagree* = 1).

Validation and Reliability

The instrument underwent rigorous validation. Face and content validity were established by a panel of five experts: two professors of Adapted Physical Education, two specialists in Special Education and Curriculum Studies, and one expert in Educational Measurement and Evaluation. Suggestions regarding item clarity, terminology, and domain coverage were incorporated into the final draft. To ascertain internal consistency, the validated instrument was pilot-tested on 40 respondents (administrators and PE teachers) in special schools not included in the final study sample. Reliability indices were calculated using three internal consistency metrics: Cronbach's Alpha (alpha): 0.824; Spearman-Brown Split-Half: 0.828 and Guttman Split-Half: 0.811

All metrics exceeded the standard benchmark of 0.70 (Pallant, 2020), confirming high internal consistency and reliability.

Data Collection Procedure & Data Analysis

Data collection was carried out over eight weeks by the researchers alongside twelve trained field research assistants, including certified sign language interpreters and braille assistants to facilitate communication with hearing-impaired and visually-impaired respondents. A total of 390 questionnaires were distributed, and through persistent follow-up, all 390 copies were retrieved, yielding a 100% retrieval rate. The collected data were cleaned, coded, and analyzed using IBM SPSS Statistics (Version 27.0). Descriptive statistics (frequencies, percentages, means, and standard deviations) were used



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to summarize demographic data, while non-parametric Chi-square (χ^2) test of independence was computed to test the null hypothesis at the 0.05 level of significance.

Presentation of Results

Hypothesis Testing

Curriculum adaptation does not significantly determine the effective implementation of Physical Education programmes in Nigeria's special schools.

Table 1: *Chi-square (χ^2) Analysis of Curriculum Adaptation as a Determinant of Effective Implementation of PE Programmes*

Variable	N	df	χ^2_{cal}	χ^2_{crit}	p-value	Decision
Curriculum Adaptation	390	27	119.13	40.113	0.000	Ho Rejected

Significance level alpha = 0.05; degrees of freedom (df) = 27.

Interpretation

The statistical analysis presented in Table 1 shows that the calculated Chi-square value ($\chi^2_{cal} = 119.13$) is substantially greater than the critical Chi-square value ($\chi^2_{crit} = 40.113$) at 27 degrees of freedom, with an associated asymptotic p-value of 0.000 ($p < 0.05$). Consequently, the null hypothesis is rejected.

This statistical outcome indicates that curriculum adaptation significantly determines the effective implementation of Physical Education programmes in Nigeria's special schools.

Discussion of Findings

The primary finding of this study demonstrates that curriculum adaptation is a fundamental determinant of successful Physical Education programme implementation within special education settings in Nigeria. Rejection of the null hypothesis ($\chi^2 = 119.13$, $p = 0.000$) underscores that when instructional activities, equipment, rules, and learning environments are modified to align with learners' functional profiles, the implementation quality of PE improves. This result corroborates the empirical findings of Ajayi (2017), who established that special schools that systematically incorporate curriculum modifications demonstrate significantly higher levels of student participation, skill acquisition, and sustained physical activity engagement. Similarly, Okafor and Adeyemi (2019) asserted that structural flexibility in instructional delivery remains the single most important predictor of educational inclusion for learners with special needs. Without deliberate curricular modifications, physical education classes risk deteriorating into spaces of physical exclusion and psychological frustration. The findings also support the theoretical work of Winnick and Porretta (2017) and Lieberman et al. (2020) regarding Adapted Physical Education (APE). These scholars emphasized that curriculum adaptation is not merely an optional instructional strategy, but a fundamental prerequisite for equitable pedagogical delivery. Modifying game parameters such as using audible balls for students with visual impairment, lowering nets and baskets for wheelchair users, reducing field dimensions, and utilizing visual task schedules for students with autism spectrum disorders directly removes participation barriers. Furthermore, the results align with Yusuf and Ibrahim (2021), who highlighted that while systemic bottlenecks such as inadequate funding, poor facility maintenance, and limited teacher training persist across public institutions in Nigeria, effective curriculum adaptation by competent teachers can attenuate these constraints. As noted by Eze and Anih (2015), adapted physical activities serve as a catalyst for motor development, emotional regulation, and social skill building among learners with neurodevelopmental disorders such as autism and intellectual disabilities. However, the field observations from this study reveal a disparity between theoretical awareness of curriculum adaptation and its daily practical application in Nigerian classrooms. While administrators and teachers recognize its importance, practical implementation is often constrained by lack of specialized APE pre-service training, absence of standardized adaptive assessment tools, and a lack of basic adaptive sports equipment (Abah et al., 2022; Adewumi & Mosaku, 2019). This underscores the imperative for systemic interventions led by government bodies and educational policymakers.

Conclusion

Based on the empirical findings, this study concludes that curriculum adaptation is an indispensable determinant of effective Physical Education implementation in Nigeria's special schools. A rigid, standardized PE curriculum fails to serve the diverse physical, sensory, and cognitive needs of students in special education institutions. Tailoring curricular content, pedagogical approaches, instructional equipment, and evaluation metrics empowers learners with disabilities to participate actively, acquire functional motor skills, and experience the physical, psychological, and social benefits of structured physical activity. Achieving the inclusive education targets set by SDG 4 and upholding Nigeria's Disability



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Rights Act of 2018 require transitioning from theoretical commitments to practical curricular adaptation across all special and inclusive schools nationwide.

Recommendations

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

1. **Curricular Reform & National APE Standardization:** The Federal Ministry of Education (FME), in collaboration with the Nigerian Educational Research and Development Council (NERDC) and the National Commission for Special Education, should review and revise the national Physical Education curriculum. The updated curriculum must embed explicit, standardized Adapted Physical Education (APE) modules, complete with guidelines for task differentiation across various disability categories.
2. **Pre-Service & In-Service Professional Teacher Development:** Teacher training institutions (Universities and Colleges of Education) across Nigeria should make Adapted Physical Education (APE) a compulsory core course for all undergraduate physical education and special education majors. Furthermore, State Universal Basic Education Boards (SUBEBs) should organize continuous professional development workshops to train in-service teachers on modern adaptive instructional strategies, assistive technology integration, and modified sports rules.
3. **Provision of Adaptive Equipment and Accessible Infrastructure:** State Ministries of Education and school administrators should allocate dedicated budgetary resources for acquiring specialized, low-cost adaptive sports equipment (e.g., sound-emitting balls, tactile boundary markers, modified sports wheelchairs, ramps, lightweight oversized racquets). School grounds and sports facilities must also be renovated to comply with accessibility standards (ramps, smooth pathways, tactile paving).
4. **Multi-Disciplinary Support and IEP Implementation:** Special schools should adopt Individualized Education Programs (IEPs) for PE delivery. Physical educators should collaborate with physiotherapists, occupational therapists, special educators, and healthcare professionals to tailor physical activities to each student's functional capability profile.

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Abstract

Subject-based influence of artificial intelligence chatbots on undergraduates' research project writing and knowledge acquisition was studied using a descriptive comparative survey research design of the cross-sectional type. Two research questions and two hypotheses were used to guide the study. The population of the study comprised all the 259 final-year undergraduates in the Department of Science and Mathematics Education, Benue State University (now Rev Fr Mosses Orshio Adasu University), Makurdi, Nigeria. From the population, a random sample of 102 final-year undergraduates was drawn and used for the study. Artificial Intelligence Chatbot and Research Questionnaire (AICRQ) and Research Knowledge Acquisition Test (RKAT) were validated by experts and trial tested on 25 students (not part of the main sample studied) and a reliability coefficient of 0.78 and 0.81 were obtained using Cronbach's Alpha. The research questions were answered by mean and standard deviation, while the hypotheses were tested using One-way ANOVA at 0.05 level of significance. The study found that a significant difference in the extent to which science education undergraduates from different course programmes utilize AI chatbots for research project writing with further Tukey Honestly Significant Difference (HSD) statistic. The study also found that a significant mean difference exists in the influence of AI chatbot usage on research knowledge acquisition among science education undergraduates from different course programmes with Tukey HSD statistic. Based on the findings of the study, it was recommended that lecturers in should integrate guided AI chatbots usage into teaching and research supervision processes to enhance undergraduates' research project writing skills and knowledge acquisition.

Keyword: Subject-based Influence, Artificial Intelligence Chatbots, Undergraduates' Research Project Writing, Research Knowledge Acquisition, Science Education

Introduction

The integration of Artificial Intelligence (AI) into education has transformed the way knowledge is created, accessed, and shared across higher institutions globally. AI technologies such as intelligent tutoring systems, machine learning platforms, and conversational chatbots are increasingly becoming part of teaching, learning, and research activities in universities. In recent years, AI chatbots like ChatGPT, Google Gemini, Microsoft Copilot, Meta AI, Grammarly AI, Icit, Scite, Consensus AI, Quilbot, Zotero, Mendeley, Research rabbit, Iris.AI, Perplexity AI, Scholarcy, Poe AI and other conversational agents



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have gained widespread acceptance among students because of their ability to provide instant responses, explanations, summaries, and research guidance (Ayua et al., 2026a, 2026b; Owan et al., 2025). The rapid advancement of these technologies has significantly influenced educational practices, particularly in higher education where students engage in research-oriented academic tasks. Scholars observed that AI-driven tools improve personalized learning, support problem-solving, and enhance students' engagement in academic activities amidst some honesty and integrity concerns which a close watch (Ayua, 2018a; Ayua & Kwagh, 2026; Ayua & Akaabo, 2016; Alemdag, 2023).

Research knowledge acquisition is an essential component of university education where all scholars including undergraduates are expected to develop and apply competencies in scientific inquiry, data analysis, literature review, and research report writing (Chukwuere, 2024). Research knowledge acquisition refers to the process through which students gain understanding, skills, and competencies necessary for conducting academic research effectively in a dynamic world characterised with paradigm shifts which researchers need to keep pace with at all time as knowledge advances (Ayua, 2018b; Ayua & Taangahar, 2024; Popoola & Haliso, 2009). In science education, research knowledge equips undergraduates with the ability to investigate educational problems scientifically and contribute meaningfully to knowledge development. However, Chukwuere (2024) posit that many undergraduates experience challenges in research activities due to inadequate mentoring, poor access to current academic materials, and limited research skills. Consequently, students increasingly rely on technological innovations such as AI chatbots to supplement their research learning experiences and improve academic understanding. Research project writing is an essential component of higher education and academic development of the students. Its aims at exploring research problems, analyse empirical evidence, and present findings systematically using structured academic frameworks and rigorous citation standards (Van Blankenstein et al., 2019). Research project writing refers to the formal, scholarly process of planning, executing, and documenting a systematic investigation aimed at discovering new facts, testing hypotheses, or solving specific theoretical or practical problems. Among the science education students, research project writing is an extended academic analysis that presents original ideas alongside a critical evaluation of existing knowledge to answer a defined research questions or test state hypotheses. This research project writing serves as the primary academic communication channel through which original findings, analytical models, and methodological procedures are presented to the broader scientific community. Research project writing is a painstaking exercise that systematically addresses the solution to an identified problem of study, which is usually guided by an approved format for conducting, writing, and presenting an organized research report under the supervision of an/some academic supervisor(s) (Ayua et al., 2022a, 2022b; Van Blankenstein et al., 2019).

Artificial Intelligence chatbots are computer programs intended to simulate human conversation and offer intelligent answers using natural language processing and machine learning algorithms (Yin et al., 2024). These chatbots can answer questions, generate ideas, summarize articles, explain concepts, and assist students during academic and research activities. In educational contexts, AI chatbots have demonstrated noteworthy potential in improving learning outcomes by offering instant response, personalized instruction, and continuous learning support. Recent studies revealed that educational chatbots positively influence students' content knowledge gaining, engagement, and higher-order thinking skills (Xu et al., 2024). The use of AI chatbots in higher education across the globe has become increasingly prominent among undergraduate students involved in research activities (Tian et al., 2024). University scholars in Nigeria are applying chatbots for producing research topics, locating pertinent literature, organizing ideas, paraphrasing content, interpreting statistical outputs, and refining academic writing (Owan et al., 2025). The growing dependence on AI-powered conversational systems is associated with their user-friendliness, suppleness, and ability to provide rapid academic assistance. Chukwuere (2024) noted that generative AI chatbots offer affordable and personalized academic support that enhances undergraduates' engagement in research and learning activities in higher education institutions. Similarly, Akpan et al. (2024) stated that AI chatbots are increasingly used for teaching, learning, academic writing, and research support across multidisciplinary educational fields. Science education undergraduates constitute a unique category of learners because their academic programmes involve intensive research, experimentation, scientific reasoning, and inquiry-based learning. These students are expected to acquire research competencies that will prepare them for effective teaching, scientific investigations, and evidence-based educational practices needed in the 21st century (Ayua, 2019). The integration of AI chatbots into science education research may therefore influence students differently depending on the subject



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specialization or disciplinary orientation (Nnaemeka & Ogunbadejo, 2024). Subject-based influence refers to the extent to which students from different science-related disciplines experience variations in the use and effectiveness of AI chatbots for research knowledge acquisition. Students in Biology Education, Chemistry Education, Computer Science Education, Integrated Science, and Mathematics Education may utilize AI chatbots differently based on the nature of their research tasks and academic requirements. Piaget's (1972) Constructivist Learning Theory is relevant to this study. The theory explains that learners actively construct knowledge through interaction, experience, and exploration rather than receiving information passively. In relation to this study, AI chatbots such as ChatGPT, Google Gemini, Microsoft Copilot, Meta AI, Grammarly AI, Icit, Scite, Consensus AI, Quilbot, Zotero, Mendeley, Research rabbit, Iris.AI, Perplexity AI, Scholarcy, and Poe AI create interactive learning opportunities where science education undergraduates can ask research-related questions, obtain immediate answers, and independently explore academic concepts. Through these interactions, students actively build and refine their research knowledge according to their subject specializations and prior learning experiences. The theory therefore chains the view that AI chatbots can improve subject-based research knowledge acquisition and project writing by encouraging active participation, investigation, and personalized learning among science education undergraduates.

Empirically, Abbas et al. (2024) studied the causes and consequences of generative AI usage among undergraduates in Pakistan higher education institutions. The findings revealed that scholars extensively used AI chatbots for creating ideas, summarizing academic content, and improving academic writing due to academic workload and the need for quality performance. The study further exhibited that AI chatbot usage positively influenced scholars' academic engagement and learning efficiency (Abbas et al. 2024). However, the study did not specifically focus on science education undergraduates nor examine AI chatbot utilization based on course of study, thereby creating a gap for the present study which focuses on subject-based influence among science education undergraduates in Makurdi. Elshaer et al. (2024) studied the moderating effects of gender and study discipline on university scholars' acceptance and use of ChatGPT in higher education in Egypt and Saudi Arabia. The findings indicated that study discipline meaningfully influenced undergraduates' acceptance and use of AI chatbots, as students in science and technology related disciplines demonstrated higher utilization levels than students in non-scientific fields. The researchers concluded that disciplinary orientation affects students' perception and utilization of AI technologies in higher education. Nevertheless, the study focused mainly on students' acceptance and general usage of ChatGPT rather than specifically examining the extent of AI chatbot utilization for research project writing among science education undergraduates. Jo (2024) did a study in South Korea on ChatGPT usage in higher education to establish factors influencing students' acceptance and application of AI chatbots for academic purposes. The study revealed that university students frequently utilized AI chatbots for academic writing, assignment support, idea generation, and research-related learning activities. The findings further showed that AI chatbots boosted scholars' self-learning aptitudes and academic engagement across various disciplines. However, despite its relevance to AI chatbot utilization in education, the study did not specifically focus on science education undergraduates or investigate differences in AI chatbot utilization based on course of study for research project writing. Furthermore, the study was conducted outside the Nigerian educational context, limiting its direct applicability. Despite the growing educational benefits of AI chatbots, concerns persist regarding the extent to which these technologies sincerely augment research knowledge acquisition among science education undergraduates (Nnaemeka & Ogunbadejo, 2024). Many scholars appear to rely heavily on AI-generated responses without critically evaluating the accuracy, originality, and scientific validity of the information gotten. However, despite the increasing use of AI chatbots among Nigerian university students, there is limited empirical indication on the subject-based influence of artificial intelligence chatbots on undergraduates' research project writing and knowledge acquisition particularly in Makurdi. Some studies have focused broadly on AI usage, academic performance, or general perceptions of chatbot technologies without specifically examining how subject specialization influences students' acquisition of research knowledge and project writing through AI chatbots. Consequently, the delinquent of this study is the insufficient empirical understanding of how subject specialization influences the use of AI chatbots and their contribution to research knowledge acquisition and project writing among science education undergraduates in a state university in Makurdi. This gap in knowledge has created uncertainty regarding whether AI chatbot technologies effectively support research learning equally across different science education subject areas.

Objectives of the Study



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Consequently, subject-based influence of artificial intelligence chatbots on undergraduates' research project writing and knowledge acquisition was studied with the following specific objectives:

1. To determine the extent to which the AI chatbots are utilized by science education undergraduates for research project writing based on course of study.
2. To find out the influence of AI chatbots usage on research knowledge acquisition among science education undergraduates based on course of study.

Research Questions

The following research questions were used to guide the study.

1. What is the extent to which the AI chatbots are utilized by science education undergraduates for research project writing based on course of study.
2. What is the influence of AI chatbots usage on research knowledge acquisition of science education undergraduates based on course of study.

Null Hypotheses

The following hypotheses were used to guide this study:

1. There is no significant mean difference in the extent to which AI chatbots are utilized by science education undergraduates for research project writing based on course of study.
2. There is no significant mean difference in the influence of AI chatbots usage on research knowledge acquisition of science education undergraduates based on course of study.

Research Methodology

The study used a descriptive comparative survey research design of the cross-sectional type. This design was deemed fitting because the study sought to describe and compare the extent of utilization of AI chatbots and their influence on research knowledge acquisition among science education undergraduates from different courses without manipulation of variables. The survey design was suitable because it allowed the researcher to gather quantitative data from a relatively large sample and make comparisons across groups (Creswell & Creswell, 2018). The population of the study was all the 259 Final-year undergraduates in the Department of Science and Mathematics Education, Faculty of Education, Rev. Fr. Moses Orshio Adasu University (formerly Benue State University), Makurdi, Nigeria. A sample of 102 was drawn using a simple random sampling. Artificial Intelligence Chatbot and Research Questionnaire (AICRQ) and Research Knowledge Acquisition Test (RKAT); developed by the researchers were used for the data collection. Section A of the data collecting instruments collected Biodata. Meanwhile, Section B of the 5-point Likert scale AICRQ with response options ranging from Very High (4) High (3) Moderate (2) Low (1), and Never (0) had 15 items which elicited data on the extent of AI Chatbots utilized by science education undergraduates in research project writing. Whereas, Section B of the RKAT had 40 multiple choice (A-D) items which drew data on the influence of AI Chatbots on research knowledge acquisition among science education undergraduates. Both the AICRQ and RKAT were validated by experts and trial tested on 25 undergraduates which were not part of the actual sample studied so as to guide against priming. Data generated from the trial testing of AICRQ and RKAT were subjected to Cronbach's Alpha and Kuder-Richason-20 which yielded reliability coefficients of 0.78 and 0.87 respectively and was deemed reliable for use in the study. The research questions were answered using mean and standard deviation, while the hypotheses were tested by One-way ANOVA at 0.05 level of significance with Tukey HSD (Tukey's Honestly Significant Difference) post-hoc Statistic to figure out exactly which groups are different from each other among the five groups of disciplines.

Presentation of Results

The results of the study were presented in the order of research questions and hypotheses as follows:

Research Question One: What is the extent to which the AI chatbots are utilized by science education undergraduates for research project writing based on course of study.

Table 1: Mean and Standard Deviation on the Extent of AI Chatbots Utilization for Research Project Writing Based on Course of Study.

Course Programme	n	Mean	Std. Deviation	Remarks
BSc Biology Education	26	3.18	0.49	High
BSc Chemistry Education	37	1.55	0.61	Moderate

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BSc Mathematics Education	7	0.71	0.03	Low
BSc Computer Science Education	8	0.67	0.00	Low
BSc Integrated Science Education	24	0.43	0.17	Never
Total	102			

Key: Very High (3.50 – 4.00), High (2.50 – 3.49), Moderate (1.50 - 2.49), Low (0.50 - 1.49), and Never (0.00 – 0.49)

Table 1 shows the mean and standard deviation on the extent to which AI chatbots are utilized by science education undergraduates for research project writing based on course of study. The result revealed that students in BSc Biology Education had the highest utilization of AI chatbots with a mean score of 3.18 and a standard deviation of 0.49, which was rated as High (H). Similarly, BSc Chemistry Education students had a mean score of 1.55 with a standard deviation of 0.61, indicating a Moderate (M) extent of utilization. On the other hand, BSc Mathematics Education students recorded a mean score of 0.71 with a standard deviation of 0.03, while BSc Computer Science Education students had a mean score of 0.67 and a standard deviation of 0.00. both were rated as Low (L) extent. Furthermore, BSc Integrated Science Education students had the lowest mean score of 0.43 with a standard deviation of 0.17, which was rated as Never (N) implying zero extent. Overall, the findings suggest that the extent of AI chatbot utilization for research project writing varies across course programmes among science education undergraduates.

Research Question Two: What is the influence of AI chatbots usage on research knowledge acquisition of science education undergraduates based on course of study.

Table 2: Mean and Standard Deviation on the influence of AI chatbots usage on research knowledge acquisition of science education undergraduates based on course of study.

Course Programme	N	Mean	Std. Deviation
BSc Biology Education	26	37.85	2.93
BSc Chemistry Education	37	30.80	.94
BSc Mathematics Education	7	24.57	1.31
BSc Computer Science Education	8	22.50	.46
BSc Integrated Science Education	24	19.04	3.63
Total	102		

The results in Table 2 display that BSc Biology Education undergraduates recorded the highest mean score ($M = 37.85$, $SD = 2.93$), signifying that AI chatbot usage had the greatest influence on their research knowledge acquisition. This was followed by BSc Chemistry Education students ($M = 30.80$, $SD = 0.94$). BSc Mathematics Education students had a mean score of 24.57 ($SD = 1.31$), whereas BSc Computer Science Education students recorded a mean score of 22.50 ($SD = 0.46$). BSc Integrated Science Education students had the lowest mean score ($M = 19.04$, $SD = 3.63$), suggesting the least influence of AI chatbot usage on research knowledge acquisition among the five course programmes. In terms of variability, BSc Integrated Science Education undergraduates had the highest standard deviation ($SD = 3.63$), indicating greater variation in responses within the group, whereas BSc Computer Science Education students had the lowest standard deviation ($SD = 0.46$), reflecting better steadiness in their responses.

Hypothesis One There is no significant mean difference in the extent to which AI chatbots are utilized by science education undergraduates for research project writing based on course of study.

Table 3: One-way ANOVA Statistics of the extent to which AI chatbots are utilized by science education undergraduates for research project writing based on course of study.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	110.756	4	27.689	134.856	.000
Within Groups	19.916	97	.205		
Total	130.672	101			

Table 3 presents the One-way ANOVA statistics on the significant mean difference in the extent to which AI chatbots are utilized by science education undergraduates for research project writing based on course of study. The result showed that the between-group mean square was 27.689, while the within-group mean square was 0.205. The calculated F-value of 134.856 with a significance value of 0.000 was obtained at 4 and 97 degrees of freedom. Since the significance value of 0.000 is less than the alpha level of 0.05, the null hypothesis which states that there is no significant mean difference in the extent to which AI chatbots are utilized by science education undergraduates for research project writing based on course of study was rejected. This implies that a significant difference exists in the extent to which science education



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undergraduates from different course programmes utilize AI chatbots for research project writing. However, the ANOVA result does not indicate which specific courses differ from one another. To determine the particular groups with significant differences, a post hoc multiple comparison test; Tukey's HSD applied and the result is presented in Table 4.

Table 4: *Tukey HSD Multiple Comparisons of extent to which AI chatbots are utilized by science education undergraduates for research project writing based on course of study.*

(I) Course Programme	(J) Course Programme	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
BSc Biology Education	BSc Chemistry Education	1.63326*	.11596	.000	1.3109	1.9556
	BSc Mathematics Education	2.47033*	.19295	.000	1.9340	3.0067
	BSc Computer Science Education	2.51795*	.18320	.000	2.0087	3.0272
	BSc Integrated Science Education	2.75684*	.12827	.000	2.4003	3.1134
BSc Chemistry Education	BSc Biology Education	-1.63326*	.11596	.000	-1.9556	-1.3109
	BSc Mathematics Education	.83707*	.18676	.000	.3179	1.3562
	BSc Computer Science Education	.88468*	.17668	.000	.3936	1.3758
	BSc Integrated Science Education	1.12357*	.11876	.000	.7934	1.4537
BSc Mathematics Education	BSc Biology Education	-2.47033*	.19295	.000	-3.0067	-1.9340
	BSc Chemistry Education	-.83707*	.18676	.000	-1.3562	-.3179
	BSc Computer Science Education	.04762	.23451	1.000	-.6043	.6995
	BSc Integrated Science Education	.28651	.19465	.583	-.2546	.8276
BSc Computer Science Education	BSc Biology Education	-2.51795*	.18320	.000	-3.0272	-2.0087
	BSc Chemistry Education	-.88468*	.17668	.000	-1.3758	-.3936
	BSc Mathematics Education	-.04762	.23451	1.000	-.6995	.6043
	BSc Integrated Science Education	.23889	.18499	.697	-.2753	.7531
BSc Integrated Science Education	BSc Biology Education	-2.75684*	.12827	.000	-3.1134	-2.4003
	BSc Chemistry Education	-1.12357*	.11876	.000	-1.4537	-.7934
	BSc Mathematics Education	-.28651	.19465	.583	-.8276	.2546
	BSc Computer Science Education	-.23889	.18499	.697	-.7531	.2753

*. The mean difference is significant at the 0.05 level.

The result in Table 4 presents the Tukey HSD multiple comparison analysis of the extent to which AI chatbots are utilized by science education undergraduates for research project writing based on course of study. The result revealed that there was a significant mean difference between BSc Biology Education and BSc Chemistry Education students (Mean Difference = 1.63326, $p = .000$), BSc Mathematics Education students (Mean Difference = 2.47033, $p = .000$), BSc Computer Science Education students (Mean Difference = 2.51795, $p = .000$), and BSc Integrated Science Education students (Mean Difference = 2.75684, $p = .000$). The Tukey HSD analysis confirms that the significant difference observed in the ANOVA was primarily due to differences among nearly all the course programmes. The only exception was between BSc Mathematics Education with BSc Computer Science Education and BSc Integrated Science Education, whose mean did not differ significantly. Therefore, the significant differences in AI chatbot utilization mainly existed between Biology and Chemistry Education students compared to the other course programmes, while Mathematics Education, Computer Science Education, and Integrated Science Education students did not differ significantly in their extent of AI chatbot utilization for research project writing.

Hypothesis Two: There is no significant mean difference in the influence of AI chatbots usage on research knowledge acquisition of science education undergraduates based on course of study.

Table 5: *One-way ANOVA Statistics of the influence in AI chatbots usage on research knowledge acquisition of science education undergraduates based on course of study.*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5003.088	4	1250.772	216.541	.000
Within Groups	560.287	97	5.776		
Total	5563.375	101			

The one-way ANOVA results presented in Table 5 show that the between-group sum of squares is 5003.088 with 4 degrees of freedom, while the within-group sum of squares is 560.287 with 97 degrees of freedom. The analysis produced an F-



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value of 216.541 with a significance (p) value of .000 ($p < .05$). Since the obtained p-value (.000) is less than the 0.05 level of significance, the null hypothesis was rejected. This indicates that there is a statistically significant mean difference in the influence of AI chatbot usage on research knowledge acquisition among science education undergraduates based on their course of study. However, the ANOVA result does not indicate which specific courses differ from one another. To determine the particular groups with significant differences, a post hoc multiple comparison test (Tukey's HSD) applied and the results is as shown in Table 6.

Table 6: *Tukey HSD Multiple Comparisons of the influence in AI chatbots usage on research knowledge acquisition of science education undergraduates based on course of study.*

(I) Course Programme	(J) Course Programme	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
BSc Biology Education	BSc Chemistry Education	7.049*	.615	.000	5.34	8.76
	BSc Mathematics Education	13.275*	1.023	.000	10.43	16.12
	BSc Computer Science Education	15.346*	.972	.000	12.65	18.05
	BSc Integrated Science Education	18.804*	.680	.000	16.91	20.70
BSc Chemistry Education	BSc Biology Education	-7.049*	.615	.000	-8.76	-5.34
	BSc Mathematics Education	6.226*	.991	.000	3.47	8.98
	BSc Computer Science Education	8.297*	.937	.000	5.69	10.90
	BSc Integrated Science Education	11.756*	.630	.000	10.00	13.51
BSc Mathematics Education	BSc Biology Education	-13.275*	1.023	.000	-16.12	-10.43
	BSc Chemistry Education	-6.226*	.991	.000	-8.98	-3.47
	BSc Computer Science Education	2.071	1.244	.460	-1.39	5.53
	BSc Integrated Science Education	5.530*	1.032	.000	2.66	8.40
BSc Computer Science Education	BSc Biology Education	-15.346*	.972	.000	-18.05	-12.65
	BSc Chemistry Education	-8.297*	.937	.000	-10.90	-5.69
	BSc Mathematics Education	-2.071	1.244	.460	-5.53	1.39
	BSc Integrated Science Education	3.458*	.981	.006	.73	6.19
BSc Integrated Science Education	BSc Biology Education	-18.804*	.680	.000	-20.70	-16.91
	BSc Chemistry Education	-11.756*	.630	.000	-13.51	-10.00
	BSc Mathematics Education	-5.530*	1.032	.000	-8.40	-2.66
	BSc Computer Science Education	-3.458*	.981	.006	-6.19	-.73

*. The mean difference is significant at the 0.05 level.

As shown in Table 6, the Tukey HSD post hoc multiple comparison test, which was conducted following the significant one-way ANOVA result in Table 5 to identify the specific course groups that differed in the influence of AI chatbot usage on research knowledge acquisition. The results indicate that almost all pairwise comparisons among the five course programmes were statistically significant ($p < .05$), except for the comparison between BSc Mathematics Education and BSc Computer Science Education. Specifically, students in BSc Biology Education differed significantly from those in BSc Chemistry Education (MD = 7.049, $p = .000$), BSc Mathematics Education (MD = 13.275, $p = .000$), BSc Computer Science Education (MD = 15.346, $p = .000$), and BSc Integrated Science Education (MD = 18.804, $p = .000$). The Tukey HSD post hoc analysis approves that the significant difference observed in the ANOVA was mainly due to differences among nearly all the subject areas. The only exemption was between BSc Mathematics Education and BSc Computer Science Education, where the means did not differ significantly. These results suggest that the influence of AI chatbot usage on research knowledge acquisition varies across science education programmes, with Mathematics Education and Computer Science Education exhibiting similar levels of influence, while the other programmes differ significantly from one another.

Discussion of Findings

The findings of this study exposed that AI chatbot usage has a significant influence on research project writing skills and research knowledge acquisition among science education scholars, with prominent differences based on subject area. This line up with the discoveries of Abbas et al. (2024), who reported that university undergraduates widely use AI chatbots for academic writing, idea generation, and summarization due to heavy academic workload, and that such usage positively



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boosts their academic engagement and learning effectiveness. Jo (2024) established that AI chatbots significantly support undergraduates' research project writing, knowledge acquisition, and independent learning across different subject areas. This study verifies these findings by displaying that AI chatbot usage powerfully influences research knowledge acquisition among science education undergraduates. The result of this study showing significant differences across courses of study is unswerving with Elshaer et al. (2024), Tian et al. (2024), and Qu et al. (2024), who all reported that disciplinary background significantly influences undergraduates' acceptance and use of AI chatbots. Elshaer et al. (2024) found that learners in science and technology-related subjects tend to use AI chatbots more than those in non-scientific fields, while Tian et al. (2024) and Qu et al. (2024) equally established that learners in science, engineering, and applied subjects demonstrate advanced engagement with AI tools for research and learning activities. This study extends these findings by specifically displaying that even within science education subjects, there are significant variations in AI chatbot utilization and its influence on research knowledge acquisition based on course of study.

Conclusion

Based on the findings of this study, it was concluded that AI chatbot usage has a significant influence on research project writing and research knowledge acquisition among science education undergraduates in Nigerian universities.

Recommendations

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

1. Lecturers in science education departments should integrate guided AI chatbot usage into teaching and research supervision processes to enhance students' research project writing skills and knowledge acquisition.
2. Universities should organize workshops and training programmes to improve students' digital literacy skills, ensuring that undergraduates across all courses of study can effectively and ethically utilize AI chatbots for academic writing and research activities.
3. Special consideration should be given to undergraduates in Mathematics, Computer Science, and Integrated Science Education, where lower levels of AI chatbot utilization were observed, to encourage balanced adoption across all science education programmes.

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Effect of Artificial Intelligence-Personalised Learning Strategy on Creative Thinking Skills of Integrated Science Undergraduate Students in Makurdi, Benue State, Nigeria

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Abstract

Creative thinking is a vital skill but seemingly lacking among undergraduates. The study investigated AI-personalised learning strategy's (AI-PLS) effect on creative thinking of integrated science undergraduates in Makurdi: Gender's moderating role. Two research questions and two hypotheses guided the study. The study adopted a pre-test post-test non-randomized control group quasi experimental research design. The study's population was 307 Integrated Science undergraduates. A purposive sample of 100 Integrated Science undergraduates was drawn. Creative Thinking Problem Solving Test with a reliability coefficient of 0.79 was used for data collection, the instrument was validated by three experts in science education. Data were analysed using mean and standard deviation to answer the research questions and ANCOVA to test the null hypotheses at 0.05 level of significance. Findings showed that; there is a significant difference in the development of Creative Thinking of undergraduates taught using AI-PLS and those taught using the Lecture Method, [$F(1, 97) = 83.805$; $p = 0.000 < 0.05$] and there is no significant difference in the development of Creative Thinking of male and female undergraduates taught Integrated Science using AI-PLS [$F(1, 31) = 1.065$; $p = 0.310 > 0.05$]. Based on the findings, it was recommended that students should be trained, enlightened and equipped with knowledge and devices such as computers for easy integration of AI-PLS in the process of teaching and learning to enhance creative thinking in Integrated Science undergraduates.

Keywords: AI-Personalised Learning Strategy, Creative Thinking, Gender, and Integrated Science

Introduction

Rapid technological development, especially in the area of Artificial Intelligence (AI), has had a revolutionary impact on many facets of human activity, including education. Nursalim et al. (2022) confirms that AI has emerged as a powerful tool capable of processing vast amount of data, identifying patterns, and making predictions with remarkable accuracy in recent years. Artificial intelligence has revolutionised academic learning by providing cutting-edge tools and techniques for imparting knowledge, abilities, and attitudes to students. Fwangnum et al. (2021) further lament that advancements in science and technology have transformed the educational system worldwide for growth, development and stability of developed nations. Students actively seek out the knowledge and skills they need in the learner-centred classroom of the twenty-first century. It is therefore necessary to support students' ability to develop unique solutions to urgent issues of the ever-evolving glob (Ayua et al., 2022; Ayua et al., 2023; Ayua et al., 2024). As the world develops, stakeholders in education are constantly looking forward for novel ways of knowledge transfer from teachers to students (Iweka & Abbott, 2016). AI offers revolutionary advancements in a variety of fields, including manufacturing, health, education, and services (Akgun & Greenhow, 2022; Russell & Norvig, 2016). AI has many uses, which include personalising learning processes, tracking student progress, and offering efficient feedback systems, clearly demonstrating its potential in education. Learning could be complicated and challenging for kids since the traditional educational system usually takes a one-size-fits-all approach, giving them the same material and training regardless of their unique needs. Students' creative thinking



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may not improve as a result of the traditional approach being utilised in Integrated Science instruction. However, as classrooms gradually transition from traditional structures to digital learning environments, schools may experience changes. A significant renovation of the educational system's structure is necessary to take advantage of this potential. Since the start of 21st century, the globe has witnessed extraordinary growth in scientific and knowledge fields, spurred by forces including knowledge revolution and rapid technological advancements Ayua et al. (2023) Interactive learning, higher-order thinking abilities, and student engagement are characteristics of a classroom in the twenty-first century. scientific teachers' failure to use more effective teaching strategies has resulted in abstraction, which makes pupils less engaged and more likely to memorise routes. Factors responsible for low creative thinking skills of learners in Integrated Science, such as learners' inability to interact directly with learning materials, wrong perception of science by learners could be as the result the strategies employed by teachers during classroom instructions, however, AI-Personalised Learning strategy can be an alternative.

AI-Personalized Learning Strategy is an Integrated Science teaching method that can focus on each student's learning process and employs AI platforms or tools to address their needs, interests, and concerns using computers and machines. According to Bernacki et al. (2021), AI-Personalized learning is widely recognised as an educational model where the teaching strategy and learning tempo are tailored to each student's needs. This variation increases students' motivation to engage more fully in the learning process and progress at their own pace. According to Hennekeuser et al. (2024), AI makes personalised learning possible by tailoring instructional materials to each student's particular requirements. Individual learners' strengths and weaknesses must be taken into account when teaching and learning, however in order to effectively improve learning, students' creative and critical thinking strengths and weaknesses receive little to no attention. However, using advanced algorithms and machine learning approaches, AI platforms can assess students' creative and critical thinking strengths allowing teachers to provide tailored curriculum content and targeted interventions (Abdallah et al., 2020; Rampersad, 2020). Research has demonstrated that students' individualised learning settings had higher levels of self-efficacy and a more optimistic outlook on their studies (Johnson & Smith, 2019). AI-driven systems that analyse enormous volumes of data to find learning gaps and adjust interventions accordingly can make these experiences possible. For example, it has been demonstrated that AI-powered platforms, such as adaptive learning systems, improve student performance and engagement by offering tailored learning routes and useful feedback.

Facione (2020) emphasised that in order to improve students' capacity to assess material and form their own opinions, teachers frequently use questioning strategies, group projects, and assignments. But AI's quick information processing and perceptive answers put conventional learning techniques to the test, casting doubt on the differences between machine-based and human learning in the classroom. The creation of adaptive learning systems, which modify instructional strategies and learning materials based on the unique characteristics of each learner, is increasingly utilising AI technologies. By offering tailored comments and suggestions, these platforms enhance learning outcomes and student engagement (Sayed et al., 2023; Kochmar et al., 2022). AI-Customized Usak (2024) and Yilmaz (2024) emphasised that the future of AI-Personalized Learning is moving toward offering increasingly advanced personalisation capabilities through adaptive learning systems, virtual tutors, and immersive learning environments. Learning strategy experiences are gaining more and more attention as they are advanced using techniques like big language models, especially ChatGPT, copilot or Gemini. Educational institutions should embrace scientific and technical advancements because they can improve the outcomes of their operations. The AI-driven educational revolution in the digital age represents a fundamental change in the transmission and acquisition of knowledge. By utilising AI technologies, educators may develop dynamic learning environments that empower students, encourage creativity, and open the door to a more inclusive and fair educational system that necessitates a departure from the conventional lecture method. The oldest method of instruction is the lecture method. This method entails introducing the subject or idea through an explanation or expository session, followed by the presentation of work examples (Tukur et al, 2016). By lecture method, learning is passive, students can be unable to build their own knowledge and abilities. Obro 2022 confirms that students have not benefited much from the lecture style because it is passive and does not provide opportunities for pupils to actively participate in their education. Opportunities for original thought and problem-solving, which are crucial abilities in Integrated Science, may be restricted by the lecture method. Students may find it difficult to apply theoretical knowledge to real-world issues without active



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engagement and practice, which would lower their overall science performance (Akpan & Umoren, 2018). During lectures, students may not be able to swiftly resolve misconceptions and misunderstandings due to the lack of rapid feedback and engagement. However, almost all instructors at institutions across the nation now employ the lecture method. In Integrated Science lecture method entails the teacher explaining Integrated Science concepts, demonstrating examples, while students listen, take notes and occasionally ask questions which in turn block the cultivation of creative thinking of students. The capacity to use one's imagination to create original and worthwhile ideas or works is known as creativity. According to Rollo (2017), one of the key skills a person can employ to deal with the world's rapid change is creativity. Thinking and producing are the two processes involved in creativity. The growth of each generation's creative capacity has recently emerged as a significant educational concern. According to Tonne et al. (2020), creative thinking is the process of attempting to perceive, discovering the laws of things, intentionally discovering new things, identifying the reason and preventing it, getting rid of the inappropriate, and developing the excellent. The capacity to approach circumstances and issues from novel angles, producing original concepts and solutions, is the essence of creative thinking. According to Ayua et al. (2023), creative thinking is a cognitive process that produces useful ideas for problem-solving under specific goals and circumstances. One of the most important abilities in Integrated Science is creativity, which is useful in many disciplines, including science.

The capacity to recognise new connections and explore uncharted territory that leads to the creation, manufacturing, or production of novel objects, concepts, methods, or solutions to issues is known as creativity. Without creativity, innovation cannot exist. Value creation is the primary indicator of both creativity and innovation. According to George (2017), creativity is a manageable ability. Learning a discipline, developing a method of thinking, and gaining a foundation of information are the first steps toward creativity. By experimenting, investigating, challenging presumptions, applying imagination, and synthesising data, a person can develop their creative skills. Learning to be creative is similar to learning a sport. It needs practice and a nurturing atmosphere to thrive. However, developing scientific information and carrying out scientific procedures and processes require creativity. The use of artificial intelligence in education, which may be gender-friendly, could totally change the way students learn in order to foster creative thinking. A person's self-representation as male or female is referred to as their gender. According to Ayua et al. (2022), it is the quality of being male or female, man or woman, boy or girl. Gender in this study refers to either male or female undergraduates who offer Integrated Science. This also means to Danjuma and Bileya (2022) that gender is perceived as a socially assigned characteristic that sets women apart from men. Gender, of course, could include the traits of being male or female, man or woman, boy or girl (Ayua & Agbedye, 2020). There is an imbalance against women in science in Africa since science is perceived as mostly a male topic of study. Girls are disproportionately under-represented in science, technology, and maths, according to Filgona (2016). Science is seen by women as a subject best left to men. When critical thinking is taken into account, Abakpa (2016) discovered that there is no discernible difference in science achievement between male and female students in cognitive structures. This suggests that gender differences have an impact on Integrated Science instruction, learning, and students' creative thinking. In an effort to teach science as a cohesive whole and give pupils a comprehensive understanding of scientific and technology material, integrated science was launched. This is due to the fact that the curriculum contains all of the many science components: Biology, Chemistry, Physics and Earth Science that are taught to students in a cohesive and comprehensive way. Integrated Science is crucial for students and the country as a whole, according to the National Policy of Education (Federal Republic of Nigeria, 2013). One of the science courses called Integrated Science aims to provide students with scientific and technological knowledge and abilities that will help them make wise decisions, create survival plans, and learn how to make a significant contribution to modern society. According to Ayodele (2016), Integrated scientific is also referred to as Basic Science, it is the foundation for a deeper comprehension of higher scientific, technology, and engineering courses. The study was anchored on Bruner's (1966) Theory of Discovery Learning which posits that learners learn best when they construct their own knowledge. Bruner stressed that learning is most effective when students are encouraged to discover principles, relationships, and concepts by themselves, rather than passively receiving information from teachers. To Bruner, education should be structured in ways that could encourage curiosity, inquiry, and problem-solving, as these processes lead to deeper understanding, long-term retention, and the development of higher-order skills such as creative thinking. Central to Bruner's theory is the idea that learning is an active, exploratory process. Bruner rejected instructional approaches that depends heavily on rote memorisation and direct



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transmission of knowledge. Instead, he outlined that learners should be presented with carefully designed problems, examples, instructions and situations that prompt them to search for patterns, formulate hypotheses, and draw conclusions. Through this process of discovery, learners engage in meaningful cognitive activity, which strengthens creative thinking. This emphasis on active engagement aligns strongly with contemporary AI-Personalised Learning environments, which are designed to place learners at the centre of the instructional process.

Empirically, research on Artificial intelligence and critical thinking presents mixed findings. Bahari (2026) carried out a study on the influence of artificial intelligence-based learning applications and student engagement on students' creative thinking skills in the Al-Qur'an Hadith subject at Madrasah Aliyah Negeri 2 Pekanbaru, both partially and simultaneously and revealed that the use of AI-based learning applications had a significant effect on students' creative thinking skills, similarly, Judijanto et al. (2025) Carried out a study on the role of Artificial Intelligence in personalised learning: Enhancing Creative Thinking in Online Classrooms and indicate that AI-based personalization significantly improves students' creative thinking, particularly in generating novel ideas, problem-solving flexibility, and originality of responses. Regarding empirical studies, Sijaj et al (2025) investigated impact of employing mobile learning in developing creative thinking skills among sixth-grade students in private schools in Bethlehem and found no statistically significant differences in the mean scores of the impact of employing mobile learning in developing creative thinking skills among sixth-grade students in private schools in Bethlehem, based on gender. Ayua et al. (2023) further examines effect of Creative-Teaching (CT) on Creative-Thinking-Elaboration (CTE) among different-ability upper-basic science students in Gboko and found that no significant difference existed in the students' CTE based on gender. Morso, Ikyernun et al. (2022) examined effect of teacher-learner improvised material on creative thinking among varied-ability upper-basic Science students in Makurdi and found that no significant difference existed in the students' creative thinking level based on gender. All of these studies are related to creative thinking and gender, however, the studies reviewed are different based on the teaching method, sample sizes and the design of the learning environment. The development of creative thinking is central to science education because it equips learners with the ability to generate new ideas, and solve problems effectively. However, research has shown that many science students exhibit low levels of creative thinking (Avwiri, 2016). The continued use of the traditional lecture method, which limits learners' participation and interaction, may contribute to this problem. Although AI-personalised learning strategy have been shown in other contexts to foster learners' engagement and cognitive development, little is known about their impact on undergraduates' creative thinking within the Nigerian context, especially in universities in Makurdi. There is also limited understanding of how gender influence the effectiveness of such strategy. Based on this background this study bid to investigate AI-Personalised learning strategy's effect on creative thinking of integrated science undergraduates in Makurdi: gender's moderating role.

Purpose of the Study

The purpose of the study is to investigate the effect of AI-personalised learning strategy on creative thinking skills of Integrated Science undergraduates in universities in Makurdi: Gender's moderating role with the following objectives

1. To find out the effect of AI-Personalised Learning Strategy on creative thinking skills of Integrated Science undergraduates in universities in Makurdi.
2. To ascertain the effect of AI-Personalised Learning Strategy on creative thinking skills of Integrated Science undergraduates in universities in Makurdi based on gender.

Research Questions

The following research questions guided the study

1. What is the difference between the mean creative thinking skills of undergraduates taught Integrated science using AI-Personalised Learning Strategy and those taught using lecture method
2. What is the difference between the mean creative thinking skills of undergraduates taught Integrated Science using AI-Personalised Learning Strategy based on gender

Research Hypotheses

The following hypotheses were used to guide the study.

1. There is no significant difference between the mean creative thinking skills of undergraduates taught Integrated Science using AI-Personalised Learning Strategy and those taught using lecture method



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2. There is no significant difference between the mean creative thinking skills of undergraduates taught Integrated Science using AI-Personalised Learning Strategy based on gender

Research Methodology

This study adopted a pre-test post-test non-equivalent control group quasi-experimental research design. This method lies between the rigor of a true experimental method (true experimental design includes random assignment to at least one control and one experimental/interventional group) and the flexibility of observational studies (Maciejewski, 2020). A population of 307 (143 males & 164 females) Integrated Science undergraduates in two regular public universities in Makurdi, Benue State, Nigeria [Joseph Saawuan Tarka University (formerly Federal university of Agriculture) and Benue State University (now Rev. Fr Moses Orshio Adasu University)] was use for the study. A sample of 100 undergraduate in 300 level was drawn using multistage sampling procedure (purposive and random inclusively) Firstly, a purposive sampling technique was used to purposively selected two co-educational regular public universities with similar facilities and academic characteristics. Secondly, the intact classes were randomly assigned to the experimental and the control groups to avoid disruption of the universities' timetables. Creative Thinking Problem Solving Test (CTPST) was used for data collection. The CTPST has two sections. Section A elicits personal information from the respondents while section B contains the 20 multiple-choice items with options each, which tests creative thinking ability involving fluency, flexibility, originality and elaboration. The instrument was validated by three experts in Science Education and trial-tested on 15 undergraduates who were not part of the actual sample for the study so as to guide against priming. The data gathered was computed using Person Product Moment Correlation statistic which yielded a reliability value of 0.79. The research assistant on the experimental group was trained on how to use the AI-Personalised Learning Strategy, and the research assistant for the control group were trained on how to use the lecture method. A pretest was administered to both the experimental and control groups before commencement of the treatment. Both groups were taught using the same topic "earth and the Universe". The experimental group was taught using AI-Personalised Learning Strategy lesson plans. Meanwhile, the control group was taught using Lecture Method lesson plans. After the five weeks of treatment, a post-test was administered in both groups. The extraneous variables such as initial difference effect, group interference, case history and teacher difference were controlled. The data collected were analysed using mean and standard deviation to answer the research questions; while the Analysis of covariance (ANCOVA) was used to test the null hypotheses at 0.05 alpha level of significance.

Presentation of Results

The results of the study are presented in order of the research questions and hypotheses as follows:

Research Questions Four: What is the difference between the mean creative thinking skills scores of undergraduates taught Integrated Science using AI-Personalised Learning Strategy and those taught using lecture method.

Table 1: Mean and Standard Deviation of Undergraduates' Creative Thinking based on Teaching Method

Method	Sample (n)	Pre-CT Mean	St. D	Post-CT Mean	SD	Gain
AI-Personalised Learning Strategy	34	6.29	3.31	17.65	7.60	11.36
Lecture Method	66	5.97	3.23	8.18	3.05	2.21
Difference		0.32		9.47		9.15

The results in Table 1 revealed that undergraduates taught Integrated science using AI-Personalised Learning Strategy had Creative Thinking mean of 6.29 with standard deviation of 3.31 in the Pre-CT and Creative Thinking mean of 17.65 with standard deviation of 7.60 in the post-CT. Undergraduates taught Integrated science using Lecture Method had Creative Thinking mean of 5.97 with standard deviation of 3.23 in the Pre-CT and Creative Thinking mean of 8.18 with standard deviation of 3.05 in the post-CT. Table 1 further shows that undergraduates taught Integrated science using AI-PLS had mean gain scores of 11.36 while those taught using LM had a mean gain score of 2.21. Thus, there was a mean gain difference of 9.15 in favour of undergraduates taught Integrated science using AI-Personalised Learning Strategy. This shows that undergraduates taught using AI-PLS developed Creative Thinking more as compared to those taught using LM. Also, SD for LM at post-CT was lower than for AI-PLS, showing that LM scores clustered closer to their means more than for AI-PLS.



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Research Questions 2: What is the difference between the mean creative thinking skills scores of undergraduates taught Integrated Science using AI-Personalised Learning Strategy based on gender

Table 2: Mean and Standard Deviation of Creative Thinking of Male and Female Undergraduates Taught Integrated Science using AI-Personalised Learning Strategy

Gender	Sample (n)	Pre-CT		Post- CT		Gain
		Mean	St. D	Mean	SD	
Male	12	6.50	3.63	19.50	7.96	13.00
Female	22	6.18	3.20	16.64	7.39	10.46
Difference		0.32		2.86		2.54

The results in Table 2 revealed that male undergraduates taught Integrated science using AI-Personalised Learning Strategy had Creative Thinking mean scores of 6.50 with standard deviation of 3.63 in the pre-CT and Creative Thinking mean scores of 19.50 with standard deviation of 7.96 in the post-CT. Female Undergraduates who were taught Integrated science using AI-Personalised Learning Strategy had Creative Thinking mean scores of 6.18 with standard deviation of 3.20 in the post-CT and Creative Thinking mean scores of 16.64 with standard deviation of 7.39 in the post-CT. Table 2 further shows that male undergraduates taught Integrated science using AI-PLS had mean gain scores of 13.00 while female undergraduates taught using the same AI-PLS had a mean gain score of 10.46 with a mean gain difference of 2.54 in favour of the male undergraduates taught Integrated science using AI-Personalised Learning Strategy. This explained that male undergraduates taught using AI-PLS developed Creative Thinking more as compared to their female counterpart undergraduates taught Integrated science using the AI-PLS. However, females had a lower SD of 7.39 over males, showing female scores laid closer to their mean scores.

Hypotheses One: There is no significant difference between the mean creative thinking skills scores of undergraduates taught Integrated Science using AI-Personalised Learning Strategy and those taught using lecture method.

Table 3: ANCOVA Summary of Undergraduates' Creative Thinking Based on Teaching Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2283.234 ^a	2	1141.617	49.419	.000	.505
Intercept	2013.497	1	2013.497	87.162	.000	.473
Pre-CT	272.816	1	272.816	11.810	.001	.109
Teaching Methods	1935.942	1	1935.942	83.805	.000	.464
Error	2240.766	97	23.101			
Total	17520.000	100				
Corrected Total	4524.000	99				

The ANCOVA statistic summary in Table 3 shows that $F_{(1,97)} = 83.805$; $p = 0.000 < 0.05$. This shows that the probability level is less than the quantified alpha of 0.05. Accordingly, the null hypothesis was rejected. This implies that there is a significant difference in the development of Creative Thinking mean scores of undergraduates taught using AI-PLS and those taught using the LM in Integrated Science. This indicates that AI-PLS significantly develops undergraduates' Creative Thinking than LM in Integrated Science. The partial eta squared value of 0.464 is considered to be a large effect size, indicating that the AI-PLS has a substantial impact on undergraduates Creative Thinking. This means that approximately, 46.4% of the variance in undergraduates' Creative Thinking scores can be attributed to the difference between the two teaching methods and also, there is a strong association between the AI-PLS and undergraduates' Creative Thinking.

Hypotheses Two: There is no significant difference between the mean creative thinking skills of undergraduates taught Integrated Science using AI-Personalised Learning Strategy based on gender

Table 4: ANCOVA Summary of Undergraduates' Creative Thinking Based on Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	63.729 ^a	2	31.864	.536	.591	.033
Intercept	2250.589	1	2250.589	37.835	.000	.550
Pre-CT	.055	1	.055	.001	.976	.000
Gender	63.361	1	63.361	1.065	.310	.033



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Error	1844.036	31	59.485
Total	12496.000	34	
Corrected Total	1907.765	33	

The ANCOVA statistic summary in Table 4 shows that $F_{(1, 31)} = 1.065$; $p = 0.310 > 0.05$. This confirms that the probability is greater than the specified alpha level of 0.05. So, the null hypothesis was not rejected. This specifies that there was no significant difference in the development of Creative Thinking mean scores of male and female undergraduates taught using AI-PLS in Integrated Science. This explains that AI-PLS is effective and has no significant gender-based differences in learning outcomes for both male and female undergraduates. The partial eta squared value of 0.033 is considered to be a very small effect size, indicating essentially equivalent development of Creative Thinking mean of male and female undergraduates when taught using AI-PLS. This means that approximately 03.3% of the variance of undergraduates' Creative Thinking can be attributed to no statistically significant difference between male and female undergraduates.

Discussion of Findings

The study made two findings and they are discussed as follows:

As regards the effect of AI-Personalised Learning Strategy (AI-PLS) and Lecture Method (LM) on Creative Thinking skills, the study found a significant difference in the development of creative thinking among Integrated Science undergraduates taught using AI-PLS and those taught using the LM, $F(1, 97) = 83.805$; $p = 0.000 < 0.05$. The AI-PLS group had a higher mean gain of 11.36 compared to 2.21 for the Lecture Method group, with a large effect size. This implies that AI-PLS is more effective than the LM in developing creative thinking skills among Integrated Science undergraduates. This finding aligns with Bruner's Theory of Discovery Learning (1966), which posits that learning is most effective when students actively engage in problem-solving and knowledge construction. AI-PLS likely promoted this by adapting content to individual learners' needs, providing immediate feedback, and encouraging exploration, which are consistent with Bahari (2026) and Judijanto et al. (2025) who reported that AI-based learning significantly improves students' creative thinking. In contrast, the passive nature of the LM limits student participation and interaction, as noted by Obro (2022), and may explain the lower gains in creative thinking. The implication is that integrating AI-PLS into Integrated Science classrooms can address the challenge of low creative thinking and shift instruction from teacher-centred to learner-centred approaches. Concerning the effect of AI-PLS on Creative Thinking based on Gender, the study found no significant difference in the development of creative thinking of male and female undergraduates taught Integrated Science using AI-PLS, $F(1, 31) = 1.065$; $p = 0.310 > 0.05$, with a very small effect size of 0.033. Although males had a slightly higher mean gain of 13.00 compared to 10.46 for females, the difference was not statistically significant. This suggests that AI-PLS is gender-friendly and enhances creative thinking irrespective of gender. This finding is consistent with Sijaj et al. (2025), Ayua et al. (2023), and Ikyernun et al. (2022) who found no significant gender differences in creative thinking when state-of-the-art teaching tactics were employed. The finding contradicts the stereotype that science is a male-dominated field and supports the need for inclusive methods in science teaching. Theoretically, this indicates that personalised learning environments created by AI can minimise gender disparities by catering to individual learning needs rather than group characteristics. Practically, the implication is that lecturers can adopt AI-PLS to foster equitable development of creative thinking skills among both male and female Integrated Science undergraduates without the fear of gender prejudice.

Conclusion

Based on the findings, the study concludes that AI-PLS has significantly enhance creative thinking skills of Integrated Science undergraduates without gender disparity. Therefore, teachers and lecturers should use Artificial Intelligence Personalized Learning Strategy for teaching of science in schools and tertiary institutions.

Recommendations

Based on the findings, the following recommendations were made:

1. Digital library should be a core recommendation for accreditation of universities to enable easy integration of AI-PLS in the process of teaching and learning
2. Students should be trained, enlightened and equipped with knowledge and devices such as computers for easy integration of AI-PLS in the process of teaching and learning to enhance creative thinking in Integrated Science undergraduates.



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3. Workshop should be organised by government, STAN and NGOs to enlighten teachers and lecturers on how to use AI-PLS for effective teaching of Integrated Science for harnessing science through creative thinking.

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Assessment on Integrating Artificial Intelligence Tools for Basic Science and Technology Teaching among Junior Secondary School Teachers in Daura, Katsina State, Nigeria

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Abstract

The integration of Artificial Intelligence (AI) into education has the potential to improve instructional delivery and students' learning outcomes. However, its adoption in Nigerian junior secondary schools remains limited, particularly in rural areas. This study examined the integration of AI tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State. Specifically, the study determined teachers' awareness and readiness to integrate AI tools, assessed the availability of AI instructional resources and challenges affecting their integration, and examined the perceived benefits of AI in teaching. A descriptive survey research design was adopted. The population comprised 124 Basic Science and Technology teachers, from which 95 respondents were selected using simple random sampling. Data were collected using the Artificial Intelligence Integration Questionnaire (AI IQ), which yielded a Cronbach's Alpha reliability coefficient of 0.82. Mean and standard deviation were used to answer the research questions, while independent samples t-test and Pearson Product Moment Correlation were used to test the hypotheses at the 0.05 level of significance. The findings revealed high teachers' awareness and readiness to integrate AI tools despite inadequate instructional facilities and infrastructural challenges. Teachers perceived AI as beneficial for improving instructional delivery and students' learning. The study recommends improved digital infrastructure, teacher training, and supportive educational policies to enhance AI integration.

Keywords: Artificial Intelligence, Basic Science and Technology, AI integration, teacher readiness.

Introduction

Digital growth is rapidly reshaping education, especially through the use of Artificial Intelligence (AI). AI refers to computer systems designed to model human problem solving, decision making, and learning (Kamalov et al., 2023). Today, tools like virtual labs, smart tutoring systems, adaptive software, and educational chatbots are recognized globally for their ability to improve teaching and learning (Younas et al., 2025). Studies show that AI effectively supports personalized learning, boosts student engagement, and helps teachers deliver better lessons (Holmes et al., 2019). Developed nations are already ahead, actively weaving AI into STEM (Science, Technology, Engineering, and Mathematics) classrooms to drive innovation and digital literacy. These countries use AI tools to tailor lessons to individual needs and prepare students with the technical skills the future job market demands (Naseri & Abdullah, 2025). However, the story is quite different in developing countries where AI adoption is slow due to poor internet connectivity, lack of basic technological resources, and a lack of training for teachers (Bali et al., 2024). In Nigeria, these issues are hit hard by broader challenges like poor school funding, missing instructional materials, and an unequal access to technology that leaves rural schools behind (Abimbola et al., 2025). This tech gap directly impacts foundational subjects like Basic Science and Technology. According to the Nigerian Educational Research and Development Council (NERDC), this subject is meant to build early scientific literacy and problem-solving skills, which requires practical and interactive teaching. AI could easily bridge this gap by offering virtual science labs, automated grading, smart tutoring, and learning platforms that adapt to a student's pace (Porayska-Pomsta et al., 2023). Yet, despite these clear benefits, the actual use of AI tools in Nigerian science classrooms remains very low. The reality is that teachers face constant power outages, a lack of working computers, and their own low digital confidence because they have not been trained on how to use AI for teaching (Agwom et al., 2025).

Statement of the Problem

Artificial Intelligence (AI) has the potential to transform the teaching of Basic Science and Technology by promoting interactive learning, improving instructional delivery, and supporting personalized learning experiences. Despite these potentials, the extent to which AI tools have been integrated into the teaching of Basic Science and Technology in public junior secondary schools, particularly in rural areas, remains uncertain. In Daura Local Government Area of Katsina State, classroom instruction in Basic Science and Technology appears to rely largely on conventional teaching methods, with limited evidence of AI-supported instructional practices. The apparent inadequacy of digital instructional facilities, coupled



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with possible variations in teachers' awareness and readiness to utilize AI tools, may hinder efforts to improve science teaching and learning in line with current technological advancements. Consequently, students may continue to experience limited exposure to innovative instructional approaches capable of enhancing scientific understanding, critical thinking, and digital literacy.

Objectives of the Study

The objectives of this study are to:

1. Determine teachers' awareness and readiness to integrate Artificial Intelligence tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.
2. Examine the availability of Artificial Intelligence instructional tools and the challenges affecting their integration in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.
3. Examine the perceived benefits of integrating Artificial Intelligence tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.

Research Questions

1. What is the level of teachers' awareness and readiness to integrate Artificial Intelligence tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State?
2. To what extent are Artificial Intelligence instructional tools available, and what challenges affect their integration in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State?
3. What are the perceived benefits of integrating Artificial Intelligence tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State?

Research Hypotheses

- H₀₁:** There is no significant difference in teachers' awareness and readiness to integrate Artificial Intelligence tools based on teaching experience in junior secondary schools in Daura Local Government Area, Katsina State.
- H₀₂:** There is no significant difference between the availability of Artificial Intelligence instructional tools and their integration in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.
- H₀₃:** There is no significant difference in teachers' perceptions of the benefits of integrating Artificial Intelligence tools based on gender in junior secondary schools in Daura Local Government Area, Katsina State.

Research Methodology

The study adopted a descriptive survey research design, which was considered appropriate for investigating the integration of Artificial Intelligence (AI) tools into the teaching of Basic Science and Technology without manipulating any of the study variables. The population comprised 124 Basic Science and Technology teachers in public junior secondary schools in Daura Local Government Area, Katsina State. A sample of 95 teachers was selected using the Krejcie and Morgan (1970) sample size determination table, after which simple random sampling was employed to select the respondents, ensuring fair representation across the selected schools. Data were collected using a structured questionnaire titled Artificial Intelligence Integration Questionnaire (AI IQ), developed by the researcher based on the objectives of the study and relevant literature. The questionnaire consisted of two sections. Section A elicited respondents' demographic information, while Section B comprised five clusters corresponding to the objectives of the study. Cluster A measured teachers' awareness of Artificial Intelligence tools, Cluster B assessed the availability of Artificial Intelligence instructional tools, Cluster C measured teachers' readiness to utilize AI tools, Cluster D identified the challenges affecting AI integration, while Cluster E assessed teachers' perceived benefits of integrating Artificial Intelligence tools in the teaching of Basic Science and Technology. The questionnaire was structured on a four-point Likert rating scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The instrument was subjected to face and content validation by experts in Science Education and Measurement and Evaluation, who assessed the relevance, clarity, and appropriateness of the questionnaire items. The reliability of the instrument was established using the Cronbach Alpha method, which yielded a reliability coefficient of 0.82, indicating that the instrument possessed satisfactory internal consistency. Data collected were analyzed using mean and standard deviation to answer the research questions, with a criterion mean of 2.50 used for decision-making. The null hypotheses were tested using independent samples t-test and Pearson Product Moment



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Correlation (PPMC) at the 0.05 level of significance using the Statistical Package for the Social Sciences (SPSS) version 25.

Presentation of Results

The results are presented according to the three research questions and the corresponding null hypotheses. Mean and standard deviation were used to answer the research questions, while independent samples *t*-test and Pearson Product Moment Correlation (PPMC) were used to test the null hypotheses at the 0.05 level of significance.

Answer to Research Questions

Research Question One

Table 1: Mean Ratings and Standard Deviations of Teachers' Awareness and Readiness to Integrate Artificial Intelligence Tools

Item No.	Item Description	SA	A	D	SD	$\bar{X}$	SD	Decision
1	AI tools improve instructional delivery in Basic Science and Technology.	38	34	11	7	3.14	0.82	Agreed
2	AI tools simplify difficult scientific concepts for students.	40	33	11	6	3.19	0.79	Agreed
3	Teachers are willing to utilize AI tools during classroom instruction.	40	33	10	7	3.18	0.80	Agreed
Cluster Mean						3.17	0.80	Agreed

Table 1 shows that all the selected items recorded mean scores above the criterion mean of 2.50. The cluster mean of 3.17 (SD = 0.80) indicates that teachers possessed a high level of awareness of Artificial Intelligence tools and were willing to integrate them into the teaching of Basic Science and Technology.

Research Question Two

Table 2: Mean Ratings and Standard Deviations of the Availability of Artificial Intelligence Instructional Tools and Challenges Affecting Their Integration

Item No.	Item Description	SA	A	D	SD	$\bar{X}$	SD	Decision
1	Computers are available for teaching and learning.	18	24	29	19	2.46	0.92	Disagreed
2	Teachers lack adequate training on AI technologies.	41	33	10	6	3.21	0.82	Agreed
3	Poor internet connectivity hinders utilization of AI tools.	44	31	9	6	3.26	0.80	Agreed
Cluster Mean						2.98	0.85	Agreed

Table 2 indicates that although teachers identified inadequate availability of Artificial Intelligence instructional facilities, they also agreed that inadequate training and poor internet connectivity constitute major barriers to AI integration. The cluster mean of 2.98 (SD = 0.85) suggests that infrastructural and capacity related challenges continue to limit the effective integration of AI tools in Basic Science and Technology classrooms.

Research Question Three

Table 3: Mean Ratings and Standard Deviations of Teachers' Perceived Benefits of Integrating Artificial Intelligence Tools

Item No.	Item Description	SA	A	D	SD	$\bar{X}$	SD	Decision
1	AI tools improve instructional delivery.	42	32	10	6	3.22	0.80	Agreed
2	AI promotes personalized learning among students.	44	30	10	6	3.24	0.79	Agreed
3	AI simplifies difficult scientific concepts during instruction.	45	29	10	6	3.26	0.78	Agreed
Cluster Mean						3.24	0.79	Agreed

Table 3 shows that respondents agreed that integrating Artificial Intelligence tools provides significant instructional benefits. The cluster mean of 3.24 (SD = 0.79) indicates that AI has the potential to improve instructional delivery, promote personalized learning, and simplify difficult scientific concepts in Basic Science and Technology.

Hypotheses Testing

Hypothesis One

H₀₁: There is no significant difference in teachers' awareness and readiness to integrate Artificial Intelligence tools based on teaching experience in junior secondary schools in Daura Local Government Area, Katsina State.



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Table 4: Independent Samples *t*-Test on Teachers' Awareness and Readiness Based on Teaching Experience

Teaching Experience	N	Mean	SD	t	df	p-value	Decision
Less Experienced (1–10 years)	42	3.09	0.41				
More Experienced (Above 10 years)	53	3.18	0.39	1.11	93	0.270	Accepted

Table 4 shows that the calculated *t*-value was 1.11 with a corresponding p-value of 0.270, which is greater than the 0.05 level of significance. Therefore, the null hypothesis was accepted. This indicates that there is no significant difference in teachers' awareness and readiness to integrate Artificial Intelligence tools based on teaching experience.

Hypothesis Two

H₀₂: There is no significant difference between the availability of Artificial Intelligence instructional tools and their integration in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.

Table 5: Pearson Product Moment Correlation between Availability of Artificial Intelligence Instructional Tools and Their Integration

Variables	N	r	p-value	Decision
Availability of AI Instructional Tools	95	0.684	0.000	Rejected
Integration of AI Tools in Teaching	95			

Table 5 indicates that the Pearson Product Moment Correlation coefficient was $r = 0.684$, with a p-value of 0.000, which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. This implies that there is a significant positive relationship between the availability of Artificial Intelligence instructional tools and their integration in the teaching of Basic Science and Technology. As the availability of AI instructional resources improves, teachers are more likely to integrate AI into classroom instruction.

Hypothesis Three

H₀₃: There is no significant difference in teachers' perceptions of the benefits of integrating Artificial Intelligence tools based on gender in junior secondary schools in Daura Local Government Area, Katsina State.

Table 6: Independent Samples *t*-Test on Teachers' Perceptions of the Benefits of Artificial Intelligence Based on Gender

Gender	N	Mean	SD	t	df	p-value	Decision
Male	58	3.25	0.40				
Female	37	3.21	0.42	0.47	93	0.640	Accepted

Table 6 shows that the calculated *t*-value was 0.47, with a corresponding p-value of 0.640, which is greater than the 0.05 level of significance. Therefore, the null hypothesis was accepted. This indicates that there is no significant difference in teachers' perceptions of the benefits of integrating Artificial Intelligence tools based on gender.

Discussion of Findings

The study revealed that Basic Science and Technology teachers in junior secondary schools in Daura Local Government Area demonstrated a high level of awareness and readiness to integrate Artificial Intelligence (AI) tools into classroom instruction. The high cluster mean suggests that teachers recognize the instructional value of AI technologies and are willing to adopt them to improve teaching and learning. This positive disposition may reflect increasing exposure to digital technologies, professional interactions, and the growing global emphasis on AI in education. This finding is consistent with Kamalov et al. (2023), who reported that educators are becoming increasingly aware of the instructional potential of AI and are willing to adopt AI-supported technologies to improve teaching effectiveness. Similarly, UNESCO (2021) emphasized that teachers generally hold positive perceptions of AI and recognize its potential to enhance instructional practices, although successful implementation depends on adequate training and institutional support. The finding, however, contrasts with Olaiya et al. (2025), who reported that many secondary school teachers demonstrated limited awareness and preparedness for integrating Artificial Intelligence into instructional delivery, largely due to inadequate awareness, low self-efficacy, and insufficient preparedness. The implication of this finding is that although teachers are positively disposed towards AI integration, sustained professional development and continuous capacity building programmes are required to translate awareness and readiness into effective classroom practice. The study found that the availability of Artificial Intelligence instructional tools in junior secondary schools in Daura Local Government Area was generally inadequate. Respondents also identified poor internet connectivity, inadequate teacher training, insufficient



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funding, unreliable electricity supply, and limited institutional support as the major challenges affecting AI integration in Basic Science and Technology instruction. This finding agrees with UNESCO (2023), which reported that inadequate digital infrastructure, unstable electricity, limited internet access, and insufficient teacher preparation remain major barriers to the adoption of Artificial Intelligence in education, particularly in developing countries. Likewise, Bali et al. (2024) identified poor technological infrastructure, inadequate funding, and insufficient professional training as significant constraints to AI integration in Nigerian schools. In contrast, Holmes et al. (2019) observed that schools operating in digitally supported learning environments with adequate technological infrastructure experienced more successful implementation of AI-assisted instructional strategies. This contrast suggests that the effectiveness of AI integration depends largely on the availability of infrastructure and institutional investment. The finding indicates that improving infrastructure alone may not guarantee successful AI implementation. Government agencies, school administrators, and other stakeholders should simultaneously address teacher training, funding, internet connectivity, and institutional support to create an enabling environment for AI integration. The study further revealed that teachers perceived Artificial Intelligence tools as beneficial for improving instructional delivery, promoting personalized learning, simplifying complex scientific concepts, enhancing classroom participation, and improving students' academic achievement in Basic Science and Technology. This finding corroborates Holmes et al. (2019), who reported that AI-supported instructional systems enhance learner engagement, facilitate personalized learning experiences, and improve teaching effectiveness. Similarly, Luckin et al. (2016) argued that AI technologies can support adaptive instruction, provide timely feedback, and improve students' learning outcomes by responding to individual learning needs. However, UNESCO (2023) cautioned that the educational benefits of AI may not be fully realized where schools lack appropriate policies, digital infrastructure, ethical guidelines, and adequately trained teachers. This observation suggests that the advantages of AI integration are dependent on supportive implementation conditions rather than the technology alone. Overall, the finding demonstrates that teachers recognize the educational value of Artificial Intelligence and believe that its effective integration could significantly improve the quality of Basic Science and Technology teaching and learning in junior secondary schools.

Conclusion

Based on the findings of this study, it was concluded that Basic Science and Technology teachers in junior secondary schools in Daura Local Government Area, Katsina State, demonstrated a high level of awareness and readiness to integrate Artificial Intelligence (AI) tools into classroom instruction. This indicates that teachers recognize the potential of AI to enhance instructional delivery and are willing to adopt these technologies in teaching when adequate support is available. The study further concluded that the effective integration of AI tools is constrained by inadequate availability of AI instructional facilities, poor internet connectivity, insufficient teacher training, inadequate funding, unreliable electricity supply, and limited institutional support. These challenges continue to hinder the adoption and effective utilization of AI technologies in Basic Science and Technology classrooms. Finally, the study concluded that teachers perceived Artificial Intelligence as a valuable instructional innovation capable of improving instructional delivery, promoting personalized learning, simplifying difficult scientific concepts, enhancing students' classroom participation, and improving academic achievement. Therefore, successful integration of AI in Basic Science and Technology education will require sustained investment in digital infrastructure, teacher capacity development, and supportive educational policies.

Recommendations

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

1. The Katsina State of Education and other relevant educational stakeholders should organize regular training, workshops, and professional development programmes to strengthen teachers' knowledge, skills, and readiness for integrating Artificial Intelligence tools into the teaching of Basic Science and Technology.
2. Government and school authorities should improve the availability of Artificial Intelligence instructional facilities by providing computers, reliable internet connectivity, stable electricity, AI-supported educational software, and other digital learning resources necessary for effective classroom implementation.
3. School administrators, policymakers, and educational stakeholders should develop and implement policies that promote the sustainable integration of Artificial Intelligence into Basic Science and Technology instruction while providing adequate funding, technical support, and monitoring to ensure that AI technologies are effectively utilized to improve teaching quality and students' learning outcomes.



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Influence of Parents' Socio-Economic Status on ... Ejale, O. J., Et. al. (2026)

Influence of Parents' Socio-Economic Status on Academic Performance among Public Secondary School Students in Cross River State, Nigeria

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Abstract

This study was carried out to examine the “Influence of Parents’ Socio-Economic Status on Students’ Academic Performance in Public Secondary Schools in Cross River State, Nigeria”. One objective of the study focused on; influence of parents’ economic status on students’ academic performance in public secondary schools in Cross River State, Nigeria and the research question and null hypothesis were in line with the objective of the study. The population for this study is 87,071 comprising of all principals’, teachers, students of public secondary schools in Cross River State. Three hundred and eighty-two (382) respondents were sampled to represent the total population. Out of the distributed copies of the questionnaire, three hundred and seventy-five (375) copies of questionnaire were retrieved. Descriptive survey was used for the study. One instrument was employed to collect data for the study. The research instrument was validated by three experts through face and content validity. The reliability index shows .783 using Cronbach Alpha for its analysis. Descriptive statistics was used to answer research question and ANOVA was used in testing the hypothesis. The findings of the study reveal that parents with stable or average socioeconomic status significantly enhance students’ academic performance in public secondary schools across the state. The economic status of parents was found to determine students’ ability to participate in both curricular and extracurricular activities. The study concludes that, parents’ economic status plays a critical role in shaping students’ academic outcomes among other. The study recommends that: parents, government, and NGOs should provide financial support and educational assistance to children from low-income families through scholarships, free textbooks, and school meal programs.

Keywords: Parent’s Economic Status, Students’ academic performance, Public secondary schools

Introduction

Socio-economic status of parents plays an important role in this dynamic, as families with limited financial resources may struggle to support their children’s education, particularly when long commutes are involved. Students from lower socio-economic backgrounds are more likely to face challenges such as absenteeism due to fatigue or the need to assist with household chores or economic activities. This reality can significantly hinder their academic performance, as consistent attendance and engagement are crucial for success in secondary education. Parents’ economic status is widely recognized as one of the most significant family-related factors influencing students’ academic performance across the world. Economic status refers to the financial capacity of parents to provide essential educational resources such as school fees, textbooks, learning materials, internet access, transportation, private lessons, nutritious food and a conducive home environment for learning (Adeyemo & Kelani, 2025). Students from economically stable families are more likely to enjoy uninterrupted schooling, regular attendance, adequate nutrition and access to modern learning technologies, all of which contribute positively to academic achievement. Conversely, students from low-income households often experience educational disadvantages arising from inadequate learning materials, poor health, irregular school attendance, inability to meet school-related expenses and limited parental support due to financial hardship. These disparities have continued to widen educational inequalities, particularly in developing countries where household income significantly determines access to quality education (Aina & Adekunle, 2022).



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In Nigeria, the economic realities confronting many households have heightened concerns about the relationship between parents' economic status and students' academic performance. According to Obiakor, (2021), rising inflation, unemployment, increasing transportation costs and declining household purchasing power have made it difficult for many parents to adequately finance their children's education. Consequently, many students in public secondary schools struggle to acquire prescribed textbooks, school uniforms, laboratory materials and digital learning devices necessary for effective learning. Parental income, occupation and educational investment significantly predict students' academic outcomes, as economically advantaged families are better positioned to provide learning opportunities that enhance academic success. Home-school distance does not operate in isolation but is closely linked to parents' economic status. Families with higher economic resources can afford accommodation closer to schools, reliable transportation, or even enrol their children in better-located schools. In contrast, economically disadvantaged families often reside in remote or rural communities where students travel long distances to attend school. The inability to afford daily transportation exposes students to fatigue, lateness, absenteeism, and reduced study time, all of which negatively affect academic performance. Thus, parents' economic status indirectly shapes the effects of home-school distance by determining students' ability to overcome transportation and accessibility challenges (Bernadine & Timson, 2026). Against this background, examining the influence of parents' economic status provides an important dimension for understanding the broader phenomenon of home-school distance and students' academic performance in public secondary schools in Cross River State, Nigeria.

Statement of the Problem

Parents' economic status constitutes a major concern in studies on home-school distance because it determines families' ability to cope with the challenges associated with long commuting distances to school. Parents with higher income levels are more likely to provide reliable transportation, pay for school buses or commercial transport, relocate closer to quality schools and meet other educational expenses that reduce the negative effects of distance on students' learning. Conversely, students from low-income households often walk long distances to school due to financial constraints, resulting in lateness, fatigue, absenteeism, and reduced concentration during classroom instruction. These conditions may ultimately contribute to poor academic performance. In Cross River State, where many communities are rural and transportation infrastructure is inadequate, the economic capacity of parents may either lessen or worsen the educational challenges associated with home-school distance. Although previous studies have acknowledged the importance of parental socioeconomic status in educational outcomes, limited attention has been given to how parents' economic status interacts with home-school distance to influence students' academic performance in public secondary schools in Cross River State. This gap underscores the need to examine parents' economic status as a significant factor in understanding the relationship between home-school distance and students' academic achievement in the study area.

Objectives of the Study

The following objective was formulated to guide the study:

1. To Examine the influence of parents' economic status on students' academic performance in public secondary schools in Cross River State, Nigeria.

Research Question

1. To what extent do parents' economic status influence students' academic performance in public secondary schools in Cross River State, Nigeria?

Null Hypothesis

H₀₁: There is no significant difference in the opinions of respondents regarding parents' economic status on students' academic performance in public secondary schools in Cross River State, Nigeria

Theoretical Framework

The theory was propounded by Abraham Maslow in 1943 as part of his paper "A Theory of Human Motivation." Maslow introduced the concept of a hierarchy of needs, which asserts that human motivation is driven by the fulfillment of basic to complex needs (Reid-Cunningham, 2008). This hierarchy is depicted as a pyramid with five levels: physiological needs, safety needs, social needs, esteem needs and self-actualization. Maslow posited that lower-level needs must be met before individuals can focus on higher-level aspirations, such as personal growth or academic achievement. For students, this framework implies that basic needs, such as food, rest, and safety, must be satisfied to facilitate optimal learning and performance. Maslow's theory revolutionized the understanding of human behavior by emphasizing the role of motivation



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in achieving potential and aligning it with environmental factors that support or hinder. In relation to home-school distance and students' academic performance, the theory suggests that students must have their basic needs, safety, and sense of security adequately met before they can effectively concentrate on learning. Long distances between home and school may expose students to fatigue, hunger, transportation difficulties, and safety risks, which hinder their ability to focus and participate actively in academic activities. Therefore, reducing home-school distance and providing safe, accessible learning environments can help satisfy students' basic and security needs, thereby enhancing motivation, school attendance and academic performance in public secondary schools in Cross River State, Nigeria

Parents' Economic Status on Students' Academic Performance in Public Secondary Schools

Parents' economic status is the financial capacity of parents or guardians to provide the educational, social, and material resources required to support their children's learning and overall academic development. It is commonly measured through indicators such as family income, parents' occupation, ownership of productive assets and the ability to meet educational expenses. In public secondary schools, parents' economic status plays a significant role in determining students' access to quality learning materials, transportation, healthcare, nutrition, digital resources and a conducive home environment, all of which directly or indirectly influence academic performance (Rintep & Akoji, 2025). Students from families with high economic status are generally more likely to achieve better academic outcomes because their parents can adequately provide school fees where applicable, textbooks, uniforms, internet access, private tutoring and other instructional materials that facilitate effective learning. According to Bankole (2024) financially stable parents are also better positioned to provide nutritious meals, comfortable accommodation and a peaceful study environment, thereby enhancing students' concentration, attendance, motivation and academic engagement. Furthermore, economically advantaged families often expose their children to educational technologies and extracurricular learning opportunities that improve cognitive development and academic achievement. Odom, Ishiwu and Osuji (2024) found that parental socio-economic status significantly influences students' academic performance, emphasizing that parental income and educational support enhance students' learning outcomes in secondary schools. Students from economically disadvantaged families frequently encounter numerous challenges that hinder academic success. Limited financial resources may prevent parents from purchasing textbooks, paying transportation costs, providing internet-enabled devices, or creating a conducive learning environment at home. Some students from low-income households engage in petty trading, farming, or other income-generating activities to support their families, reducing the time available for studying and completing assignments. Financial hardship may also result in absenteeism, lateness, psychological stress, poor nutrition and irregular school attendance, all of which negatively affect academic performance.

Parents' economic status influences the level of parental involvement in education. According to Atolagbe, Oparinde and Umaru (2019) parents with stable incomes are more likely to participate actively in school activities, monitor their children's academic progress, communicate with teachers, and provide continuous academic encouragement. Although financial resources alone do not guarantee academic excellence, they create opportunities for sustained educational support and improved learning experiences. Within the context of public secondary schools in Cross River State, parents' economic status may determine students' ability to cope with challenges associated with long home-school distances. Families with adequate financial resources can afford reliable transportation, bicycles, motorcycles, or boarding facilities that reduce travel fatigue and improve punctuality, attendance and classroom participation. In contrast, students from low-income households often trek long distances to school, arrive late, become physically exhausted and experience reduced concentration during lessons. Consequently, parents' economic status may either mitigate or exacerbate the influence of home-school distance on students' academic performance (Bankole, 2024). Therefore, improving household economic conditions and providing targeted educational support for students from low-income families are essential strategies for enhancing academic performance in Nigerian public secondary schools

Research Methodology

This study adopted a descriptive survey research approach. Descriptive survey design is a method that is use to gather information about a particular population or phenomenon at a specific point in time, it is commonly employ to examine characteristics, perceptions, behaviours, or conditions within a defined group. The population of this study is 87,071 which comprises of all the public secondary school principals, teachers and students in Cross River State, Nigeria. Cross River State have a total number of 355 public secondary schools' principals, 4,988 teachers and 81,728 students. Cross River



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State comprises of three (3) Educational Zones; Calabar Educational Zone, Ikom Educational Zone and Ogoja Educational Zone. The sample size for this study is 382. The decision to use 382 sample sizes was based on the Research Advisors Table (2006) of sample specification. Simple random sampling technique using balloting was used by the researcher to select six (6) Local Government Areas out of the total 18 Local Government in the State. As regard, the selection of sample Local Government is in line with Olayiwola (2007) who stated that 10-30% of a population can be used as a sample to represent the entire population. The researcher wrote the names of all local government in each educational zones in the state and shuffle thereafter, asked one research assistant to pick 2 local government each out of the three (3) educational zones within the state. Thereafter, proportionate sampling was adopted in selecting the principals, teachers and students to respond to the questionnaire. This technique was used because of the uneven distribution of Educational Stakeholders across each Educational Zones. A self-structured questionnaire was used to collect information from the respondents. The instrument, developed by the researcher, included five (5) items on a five-point Likert scale: SA (Strongly Agree), A (Agree), U (Undecided), D (Disagree), and SD (Strongly Disagree). Data were analyzed using mean for the research questions, while the hypothesis was tested using ANOVA.

Presentation of Results

Research Question One:

To what extent do parents' economic status influence students' academic performance in public secondary schools in Cross River State, Nigeria?

This section examines respondents' perspectives on the influence of parents' economic status on students' academic performance in public secondary schools in Cross River State, Nigeria. It directly addresses research question, which seeks to determine the views of principals, teachers, and students regarding the degree to which parents' economic status has influence students' academic performance in public secondary schools in Cross River State, Nigeria.

Table 1: Analyzes the Influence of Parents' Economic Status on Students' Academic Performance in Public Secondary Schools in Cross River State, Nigeria.

S/N	Item Statements	Category of Respondents	SA	A	U	D	SD	Mean
1	Parents' ability to prompt payment of school fees affects students' academic performance	Principals	46	17	1	5	5	4.27
		Teachers	88	19	3	4	2	4.61
		Students	113	51	19	1	1	4.48
2	The economic status of parents influences the quality of educational materials that their children use in school.	Principals	28	30	6	4	6	3.95
		Teachers	79	27	4	3	3	4.52
		Students	115	61	1	3	5	4.50
3	Students perform better academically when parents can provide all necessary school materials	Principals	55	11	4	1	2	4.97
		Teachers	88	25	1	1	1	4.71
		Students	119	45	11	8	2	4.46
4	Parents' economic status determines students' ability to participate in extracurricular activities.	Principals	38	28	3	3	2	4.31
		Teachers	69	39	2	4	2	4.46
		Students	125	49	3	4	4	4.55
5	The financial situation at home affects students' concentration and focus on studies.	Principals	51	16	1	3	3	4.47
		Teachers	83	21	4	3	5	4.50
		Students	111	47	8	11	8	4.31
6	The economic challenges faced by parents negatively impact students' motivation to excel academically.	Principals	38	23	2	6	5	4.12
		Teachers	82	22	8	2	2	4.55
		Students	89	68	7	11	10	4.16
7	Parents' economic status affects the level of support students receive academically	Principals	37	28	4	3	2	4.28
		Teachers	69	33	8	2	4	4.39

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		Students	115	67	1	1	1	4.59
8	The economic difficulties of parents cause students to worry, which affects their academic performance.	Principals	27	30	7	5	5	3.93
		Teachers	89	18	3	4	2	4.62
		Students	150	24	5	2	4	4.70
9	Students feel less confident in their studies because of the financial struggles at home.	Principals	36	29	5	3	1	4.30
		Teachers	85	23	5	2	1	4.63
		Students	127	41	7	6	4	4.52
10	Students experience stress due to parents' financial situation, which affects their academic performance.	Principals	47	16	7	3	1	4.42
		Teachers	83	27	1	4	1	4.61
		Students	99	57	9	12	8	4.23
Cumulative								4.44

Source: Researcher's Field Work (2026)

Table 1 summarizes respondents' views on the influence of parents' economic status on students' academic performance in public secondary schools in Cross River State, Nigeria. The findings revealed that all the mean scores exceeded the benchmark of 3.00, with a grand mean of 4.44, indicating respondents' agreement that parents' economic status significantly influences students' academic performance. The results suggest that financially stable parents are better able to support their children's educational needs, facilitate participation in academic and extracurricular activities, and provide resources that enhance learning outcomes. The findings also indicate that government interventions, such as scholarships, bursaries, free tuition and subsidized instructional materials, play an important role in reducing financial barriers and promoting equitable educational opportunities for students from low-income households.

Null Hypothesis One (H₀₁):

H₀₁: There is no significant difference in the opinions of respondents regarding parents' economic status on students' academic performance in public secondary schools in Cross River State, Nigeria

Table 2: Analysis of Variance (ANOVA) on the perceptions of principals, teachers and students on influence of parents' economic status on students' academic performance in public secondary schools in Cross River State, Nigeria

Source	Sum of Square	Df	Mean Square	F-ratio	P-value	Decision
Between Groups	242.839	2	121.42	74.58	0.060	H ₀₁ Retained
Within Groups	164.494	373	0.442			
Total	407.333	375				

Source: Researcher's Field Work (2025)

Table 2 reveals that the computed probability value of 0.060 exceeded the study's alpha level of 0.05. Therefore, the null hypothesis was retained, indicating that there were no statistically significant differences in the opinions of principals, teachers, and students regarding parents' economic status on students' academic performance in public secondary schools in Cross River State, Nigeria.

Summary of Finding

Students whose parents have stable or average socioeconomic status tend to achieve better academic outcomes because they receive consistent financial, emotional and educational support throughout their schooling. Such parents are also more capable of providing learning resources and enabling their children to actively participate in curricular and extracurricular activities, which further enhances their academic performance and overall development.

Discussion of Findings

The findings of this study also revealed that parents' economic status plays a crucial role in shaping students' academic performance in public secondary schools across Cross River State. Students from financially stable or average-income families performed significantly better compared to their peers from low-income households. This is because economically empowered parents are able to provide essential educational resources such as textbooks, exercise books, uniforms, digital devices, and consistent transport fares, which facilitate effective learning. In contrast, students from disadvantaged backgrounds often face challenges such as irregular attendance, inability to pay school levies, and lack of study materials,



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all of which negatively affect their academic outcomes. These findings confirm the broader understanding that socioeconomic status is a key determinant of educational attainment and access to opportunities for learning (Nwokike and Nwadike, 2023). The study further demonstrated that parents' financial strength not only supports academic needs but also determines the extent of students' participation in extracurricular and enrichment activities. Respondents noted that students from higher or average socioeconomic families are more likely to attend extra lessons, have access to private tutors, and engage in school programs that broaden their learning experience. On the other hand, students from low-income homes tend to combine academic demands with household chores or petty trading to support family income, which reduces the time and energy they can devote to learning. This imbalance contributes to disparities in academic performance and often widens the gap between students from different economic backgrounds within the same schools (Adeyeye, 2023). The evidence underscores the significant advantage that financial stability offers in enhancing students' motivation, focus, and readiness to succeed academically. The implications of these findings highlight the need for deliberate government interventions and community support to mitigate the effects of poverty on education. The state government has already initiated programs such as scholarship schemes, bursaries, and free tuition to reduce the financial strain on low-income families, but these efforts need to be expanded and sustained. Provision of subsidized or free educational materials, improved school feeding programs, and financial assistance targeted at vulnerable students would help bridge the educational gap caused by economic inequality. In accordance to (Chukwuma & Ibe, 2024) supporting disadvantaged families and ensuring that all students, regardless of parental income, have access to the same educational opportunities, the government can significantly enhance equity and improve overall academic performance in public secondary schools across Cross River State

Conclusion

Based on the findings of the study, it is concluded that parents' socioeconomic status has a significant influence on students' academic performance in public secondary schools. Students from financially stable households are more likely to achieve better academic outcomes because they receive adequate financial, emotional and educational support that promotes effective learning and active participation in school activities.

Recommendations

Based on the finding and conclusion of the study, it has been recommended that:

1. Government should strengthen financial support programmes, such as scholarships, bursaries and educational grants, for students from low-income families to reduce the adverse effects of poor parental economic status on their academic performance in public secondary schools.
2. Parents should be encouraged through school-community partnerships and awareness programmes to prioritize educational support for their children by providing essential learning materials and creating a conducive home environment that promotes academic success, regardless of their economic status.

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Effect of Digitized Jigsaw II Instructional Strategy on ... Luwoye, A. (2026)

Effect of Digitized Jigsaw II Instructional Strategy on Misconceptions in Cell Biology Concept among University Undergraduate Students in Ondo State, Nigeria

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Abstract

The study investigated the effect of digitized jigsaw II instructional strategy on remediating misconceptions in Cell Biology among undergraduates in Ondo State, Nigeria. Two purposes and two hypotheses guided the study. Quasi-experiment of pre-test, post-test, non-equivalent control group design was adopted for the study. Purposive sampling technique was used to select 64 undergraduates across two universities participated in this study. Two research instruments were used for the collection of data and they include; Cell Biology Conception Test (CBCT) and Digitized Jigsaw II Instructional package (DJIP). The CBCT and DJIP were given to three experts in the Department of Biological Sciences and Department of Science Education, Al-Hikmah University, Ilorin for face and content validity. The data collected in the pre-test and post-test of both groups was analyzed using t-test statistics at 0.05 level of significance. This study found a significant difference in the number of misconceptions remediated between students taught using the digitized jigsaw II strategy and those taught using conventional teaching methods. Also, there was no significant difference in the number of misconceptions remediated between male and female students when taught cell biology using the digitized jigsaw II strategy. It is recommended that Biology Lecturers should adopt the digitized Jigsaw II strategy for teaching cell biology without gender-based differentiation in order to improve undergraduates' understanding and remediate their misconceptions in biology.

Key words: Misconception, Digitized Jigsaw II Strategy, Canvas, Undergraduate, Cell Biology

Introduction

Biology is the scientific study of living organisms and their interactions with the physical environment, and it plays a critical role in human health, economic development, and environmental sustainability. Advances in biological knowledge have contributed significantly to medicine, agriculture, biotechnology, and disease control, making Biology a foundational discipline for scientific literacy and national development (Augustine, 2018; Jadhav et al., 2024). Among its many sub-disciplines, cell biology occupies a central position in the life sciences curriculum, particularly at the tertiary level, as it underpins genetics, molecular biology, physiology, growth and development (Rashid et al., 2023). Cell biology, also known as cytology, focuses on the structure, function, and organization of cells the basic structural and functional units of life. Mastery of cell biology concepts is essential for understanding complex biological processes and for success in advanced biological and health-related studies. However, due to the abstract and microscopic nature of cellular structures and processes, students often experience difficulty developing accurate conceptual understanding. As a result, many undergraduates harbor persistent misconceptions about cell structures, functions, and interactions, which negatively affect learning outcomes and scientific reasoning (Dorji & Zam, 2024).

Misconceptions in biology are ideas that conflict with scientifically accepted explanations and often arise from prior experiences, preconceptions, cultural beliefs, or ineffective instructional approaches (Laksana, 2016). In cell biology, such misconceptions can impede meaningful learning and remain resistant to change if not deliberately addressed. Research has shown that students' poor performance in Biology is not solely attributable to curriculum difficulty but also to instructional practices that rely heavily on teacher-centered methods, limited instructional materials, and inadequate opportunities for active learning (Abimbola, 2013; Adeoye et al., 2022; Avwiri & Okoli, 2021). Traditional lecture-based approaches often fail to engage students actively or confront their alternative conceptions, thereby allowing misconceptions to persist. Consequently, science education researchers have advocated for learner-centered instructional strategies that promote interaction, collaboration, and conceptual change. Among these, cooperative learning has been widely recognized for enhancing academic achievement, social skills, and deeper understanding of scientific concepts (Aziz & Hossain, 2010). The Jigsaw II instructional strategy, a structured form of cooperative learning, emphasizes peer teaching, positive interdependence, and individual accountability. In this approach, students become experts in specific content areas and



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subsequently teach their peers, fostering active engagement and deeper conceptual processing. Empirical studies have demonstrated the effectiveness of the Jigsaw II strategy in improving students' achievement and conceptual understanding in Biology and other science subjects (Chukwu & Arokoyu, 2019; Saffkolam et al., 2023; Tabiolo & Rogayan, 2019). With the increasing integration of digital technologies into higher education, digitizing cooperative learning strategies offers additional opportunities to enhance learning. A digitized Jigsaw II strategy incorporates online platforms, digital resources, and interactive tools to support collaboration, visualization, and accessibility, particularly in contexts where instructional resources are limited (Duda & Adpriaydi, 2020). This approach holds promise for addressing abstract concepts in cell biology and facilitating the remediation of students' misconceptions. Few studies have been conducted on identifying and remediating students' misconceptions in biology using learner-centered instructional strategies. Retone and Prudente (2023) assessed undergraduates' misconceptions on central dogma of molecular biology. This study developed a three-tier diagnostic test to identify misconceptions carried forward to undergraduate students enrolled in biologically related courses. This study found that the respondents have a low understanding of the central dogma and they have acquired misconceptions pertaining to transcription, types of RNA, and translation. Luwoye *et al.* (2021) used demo kit to remediate senior school students' misconceptions in mitosis and meiosis in Ilorin. Findings revealed that Biology students held many misconceptions on cell division. Ogundare *et al.* (2020) employed concept-mapping to remediate the misconceptions about ecology held by senior school students in Oyo. The results showed that biology students had many misconceptions about ecology, and that only one out of every four of the students' misconceptions was remediated by the concept-mapping instructional strategy. Despite growing evidence supporting cooperative and technology-enhanced learning, limited empirical studies have examined the effectiveness of a digitized Jigsaw II strategy in correcting undergraduates' misconceptions in cell biology, particularly within tertiary institutions in Ondo state. None of these previous studies have been able to use online platform as a means to remediate misconceptions of cell biology among undergraduates so the knowledge gap arises in the use of digitized jigsaw instructional strategies to remediate students' misconceptions and improve the academic performance of undergraduates. Consequently, this study investigated the effect of digitized jigsaw II instructional strategy on remediating the misconceptions of cell Biology held by undergraduates in Ondo State with the aim of contributing evidence-based insights to biology education research and instructional practice.

Purpose of the Study

The main purpose of the study is to investigate the effect of digitized jigsaws instructional strategy on remediating misconceptions in Cell Biology among undergraduates in Nigeria. Specifically, this study;

1. Find out the influence of digitized jigsaw II instructional strategy on remediating misconceptions in cell biology among undergraduates in Ondo state
2. Investigate the difference in misconceptions remediated among male and female undergraduates when taught cell biology using digitized jigsaw II instructional strategy.

Research Hypothesis

H₀₁: There is no significant difference in the number of misconceptions remediated among undergraduates taught cell biology using digitized jigsaw II and those taught using conventional teaching

H₀₂: There is no significant difference in the number of misconceptions remediated among male and female undergraduates when taught cell biology using digitized jigsaw II instructional strategy

Research Methodology

The research design for this study was a quasi-experiment of pre-test, post-test, non-equivalent control group design. Experimental group was treated with digitized jigsaw II strategy while the control group will be exposed to conventional teaching. The population of the study comprises all undergraduates offering cell biology course in universities in Ondo state. The target population for the study comprised all 200 level undergraduates offering cell biology in universities in Ondo state. Purposive sampling technique was used to select 64 undergraduates across the two institutions that participated in this study. Two research instruments were used for the collection of data and they include; Cell Biology Conception Test (CBCT) and Digitized Jigsaw II Instructional package (DJIP). Cell Biology Conception Test (CBCT) consists of thirty-two multiple choice questions on cell biology. The multiple-choice questions were designed by the researcher based on the objectives and content of the course. The options consisted of correct answer and students' misconceptions. This digitized Jigsaw II strategy was carried out on online open source Learning Management System called canvas. The CBCT and DJIP were given to three experts in the Department of Biological Sciences and Department of Science Education, AI-



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Hikmah University, Ilorin for face and content validity. The CBCT was administered to 10 undergraduates in a non-participating but equivalent university for the pilot study. The data was calculated using Cronbach Alpha and a reliability index of 0.78 was obtained. The CBCT was administered as pre-test to determine students' level of understanding and misconceptions in cell biology prior to their exposure to treatments. The experimental group was treated with digitized Jigsaw II instructional strategy targeting misconceptions already identified through the pre-test result of CBCT. The researcher downloaded, registered canvas and added the students through their email address. The researcher divides cell biology contents into different modules and uploads them. The subtopics were divided into seven modules and assigns individual students into group. Each student in the home group was assigned to their module and they downloaded the contents and study it independently. This was done completely on canvas online open learning management system. The biology lecturer (serving as research assistants) guides the control group through the use of conventional teaching which was used by undergraduates to learn cell biology. After four weeks of exposing students to treatment using digitized jigsaw II strategy and conventional teaching method for learning cell biology, students in the experimental and control groups were post tested to determine their understanding and the misconceptions held by undergraduates using the CBCT but with reshuffled questions. The data collected in the pre-test and post-test of both groups was analyzed using t-test statistics through Statistical Package for Social Sciences (SPSS) version 23.

Presentation of Results

The hypotheses are tested at 0.05 level of significance and the results are presented in the following tables;

H₀₁: There is no significant difference in the number of misconceptions remediated among undergraduates taught cell biology using digitized jigsaw II and those taught using conventional teaching.

Table 1: Independent sample t-test of misconceptions remediated among undergraduates taught cell biology using digitized jigsaw II and those taught using conventional teaching.

Groups	Number	Mean	SD	Df	Cal. T	p-value	Remark
Exper. (DJII)	32	21.38	9.892	62	3.469	0.002	Rejected
Control group	32	10.94	6.855				

Sig. at $p < 0.05$

Table 1 revealed that the mean number of misconceptions remediated in digitized jigsaw II group is 21.38 while mean number of misconceptions remediated in conventional teaching group is 10.94. The standard deviation of the misconceptions remediated in experimental and control groups are 9.892 and 6.855 respectively. The mean shows that on average, students taught using digitized jigsaw II had more misconceptions remediated than those taught using conventional teaching, with a noticeably higher mean in the digitized jigsaw II group. Also, the independent sample t-test result shows that at degrees of freedom 62, the calculated t-value is 3.469 and p-value of 0.002. The calculated t-value (3.469) is associated with a p-value of 0.002. The p-value of 0.002 which is less than 0.05 significance level (Cal. $t = 3.469$; $p = 0.002 < 0.05$) indicating that the difference in the number of misconceptions remediated between the two groups is statistically significant. Since the p-value is less than 0.05, the null hypothesis is rejected. This indicates that there is a significant difference in the number of misconceptions remediated between undergraduates taught using digitized jigsaw II and those taught using conventional teaching methods. The statistical analysis suggests that the use of digitized jigsaw II significantly increased the remediation of misconceptions in cell biology compared to conventional teaching methods among undergraduates. Therefore, digitized jigsaw II is more effective in remediating misconceptions than the conventional teaching method

H₀₂: There is no significant difference in the number of misconceptions remediated among male and female undergraduates when taught cell biology using digitized jigsaw II instructional strategy

Table 2 Independent sample t-test of misconceptions remediated among male and female undergraduates when taught cell biology using digitized jigsaw II instructional strategy

Gender	Number	Mean	SD	Df	Cal. T	p-value	Remark
Male	20	19.30	8.832	30	-1.090	0.294	Not Rejected
Female	12	24.83	11.409				

Sig. at $p < 0.05$



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Table 2 revealed that the mean number of misconceptions remediated among male undergraduates is 19.30 while mean number of misconceptions remediated among female undergraduates is 24.83. The standard deviation of the misconceptions remediated among male and female undergraduates are 8.832 and 11.409 respectively. The mean indicates that on average, male undergraduates had slightly more misconceptions remediated than female undergraduates when taught cell biology using digitized jigsaw II instructional strategy. t-test result shows that at degrees of freedom 30, the calculated t-value is -1.090 and p-value is 0.294. The calculated t-value of -1.090 is associated with a p-value of 0.294. The p-value of 0.294 is greater than the significance level of 0.05 (Cal. $t = -1.090$; $p = 0.294 > 0.05$) indicating that the difference in the number of misconceptions remediated between male and female undergraduates is not statistically significant when taught cell biology using digitized jigsaw II instructional strategy. Since the p-value is greater than 0.05, the null hypothesis is not rejected. This suggests that there is no significant difference in the number of misconceptions remediated between male and female undergraduates when taught using the digitized jigsaw II instructional strategy. The statistical analysis suggests that there is no significant difference in the effectiveness of the digitized jigsaw II instructional strategy in remediating misconceptions in cell biology between male and female undergraduates. Gender does not significantly influence the number of misconceptions remediated when using digitized jigsaw II instructional strategy.

Discussion of Findings

This study found a statistically significant difference in the number of misconceptions remediated between students taught using the digitized jigsaw II strategy and those taught using conventional teaching methods. The observed significant difference suggests that the digitized Jigsaw II strategy provides a more effective learning environment for addressing undergraduates' misconceptions in cell biology than traditional teaching methods. This effectiveness may be attributed to its collaborative and interactive structure, which promotes deeper conceptual understanding and active engagement among learners. This finding is consistent with Solviana et al., (2024) who found that an e-module PJBL-based interactive with a scientific approach is quite effective in remediating students' misconceptions about structural material and the function of plant tissue. It also corroborated with Yusuf et al. (2012) findings who revealed that computer supported STAD and Jigsaw instructional strategies enhance student performance. The digitized jigsaw II approach involves more interactive, focused, and student-centered learning, which may help students confront and revise their misconceptions. Digitized jigsaw II strategy could include specific activities or discussions that directly address common misconceptions, thereby leading to more effective remediation. The finding indicates that the digitized jigsaw II instructional strategy is significantly more effective than conventional teaching methods in remediating misconceptions in cell biology among undergraduates. The finding suggests that incorporating digitized jigsaw II into cell biology instruction can significantly improve students' understanding by helping them overcome their misconceptions. This makes it a valuable tool for educators looking to enhance conceptual clarity and deepen students' comprehension of the subject matter. The study also found no statistically significant difference in the number of misconceptions remediated between male and female students when taught cell biology using the digitized jigsaw II strategy. The absence of a significant gender difference suggests that the digitized Jigsaw II strategy provides an inclusive learning environment in which both male and female undergraduates benefit equally in correcting misconceptions in cell biology. This is corroborated by the research of Jiyah (2016) who found that there is no significant difference in the achievement of male and female biology students when use hands-on with minds-on strategy to learn cell division. It is also consistent with the research of Jimoh, et al., (2016) who revealed that gender did not contribute significantly to varying students' achievement scores. The finding is important for educators because it suggests that digitized jigsaw II can be confidently used in mixed-gender classrooms without worrying about gender-related differences in learning outcomes. This supports the use digitized jigsaw II as an inclusive and equitable instructional strategy. The primary focus of this finding is on the remediation of misconceptions in cell biology. The fact that the strategy is equally effective for both male and female students highlight its robustness and versatility in achieving this educational goal. It shows that the method can be applied broadly to remediate misconceptions without introducing gender bias. This finding indicates that the digitized jigsaw II instructional strategy is equally effective in remediating misconceptions in cell biology among both male and female undergraduates. The strategy's gender-neutral impact makes it a valuable and inclusive tool for educators seeking to improve students' understanding of complex concepts.



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Conclusion

The integration of a digitized Jigsaw II instructional strategy presents a promising pathway for addressing the critical challenges of persistent misconceptions in cell biology among undergraduate learners. This approach also enhances conceptual understanding by fostering collaborative learning through digital platforms. The findings of this study underscore the potential of cooperative, technology-enhanced pedagogies to transform biology education in resource-constrained environments. This strategy is gender-neutral, making them reliable and inclusive outfits for educators aiming to remediate misconceptions in their classrooms. The digitized Jigsaw II model exemplifies how thoughtful instructional design can empower learners and correct misconceptions to improve the quality of science education.

Recommendations

1. Teacher training programs and professional development workshops should emphasize the use of digitized collaborative strategies such as Jigsaw II to promote effective misconception correction among diverse learner populations.
2. Biology Lecturers should adopt the digitized Jigsaw II strategy for teaching cell biology without gender-based differentiation. Since gender does not significantly influence its effectiveness in remediating misconceptions, lecturers and curriculum planners should integrate this strategy as a gender-inclusive and equitable instructional approach in undergraduate biology classrooms

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Correlationship Between Hardware Assistive Technology Integration and Academic Performance among Secondary School Science Students with Learning Disabilities in Adamawa State, Nigeria

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Abstract

This study investigated hardware assistive technology as a predictor of academic performance among secondary school science students with learning disabilities in Adamawa State, Nigeria. The study was guided by one objective, one research question, and one null hypothesis. A predictive correlational research design was employed, with a target population comprising 294 science students with learning disabilities from four special education centres in Adamawa State. A sample of 133 students was selected using purposive sampling technique based on identified learning disabilities, class level, and length of stay in school. Data were collected using a structured questionnaire titled Assistive Technology Questionnaire (ATQ) and an academic performance proforma. The instruments were validated by three experts and achieved a reliability coefficient of 0.83 using Cronbach Alpha. Descriptive statistics of mean and standard deviation were used to answer the research question, while linear regression analysis was employed to test the null hypothesis at a 0.05 level of significance. The findings revealed that the level of use of hardware assistive technology was high (Grand Mean = 3.93, S.D = 1.21). Regression analysis showed that hardware assistive technology significantly predicted academic performance, $F(1,131) = 44.935$, $p < 0.05$, accounting for 25.5% of the variance ($R^2 = 0.255$). The study concluded that hardware assistive technology is a significant positive predictor of academic performance among students with learning disabilities. It was recommended that schools continue to provide and upgrade hardware tools such as computers, Braille devices, and audio equipment to sustain and improve students' learning outcomes, and that the Ministry of Education should develop policies to ensure equitable distribution of hardware assistive technologies across all special education centres.

Keywords:

Introduction

Science education is widely acknowledged as a cornerstone of individual development and societal progress. It equips learners with essential knowledge, skills, and values necessary for meaningful participation in economic, social, and civic life. In recent decades, global educational reforms have increasingly focused on equity and access, recognizing education as a fundamental right that should be available to all learners regardless of ability or background (Maya, 2018). This shift reflects the understanding that sustainable national development depends on an educated population and that exclusion from education perpetuates inequality and poverty. The recognition of science education as a fundamental human right has led to international frameworks and national policies aimed at ensuring that no learner is left behind due to disability, socio-economic status, or other barriers. Building on this foundation, inclusive education has emerged as a central principle of modern educational systems. The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) affirms inclusive education as a human right, emphasizing that students with disabilities must be provided equal learning opportunities alongside their peers (United Nations, 2018). Inclusive education promotes the integration of learners with diverse needs into mainstream classrooms while ensuring appropriate support services. In Nigeria, the National Policy on Education prioritizes inclusive education and aims to provide equitable learning environments for all students (Federal Republic of Nigeria, 2013). The policy recognizes that science students with special needs require specialized support to access the curriculum and achieve their full potential. Research indicates that, science students with learning disabilities benefit significantly from individualized instructional approaches and specialized learning resources (Higwayin, 2019;



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Bode, 2017; Wafka, 2019; Joka, 2023). Learning disabilities are neurodevelopmental conditions that affect students' ability to acquire, process, or use information effectively, particularly in areas such as reading, writing, mathematics, and problem-solving. These conditions include dyslexia (difficulties in reading accuracy, fluency, and comprehension), dyscalculia (difficulties in understanding numbers, arithmetic, biology and mathematical reasoning), and attention disorders (conditions marked by persistent difficulties in sustaining attention, regulating impulses, and organizing tasks). Students with these conditions often struggle with traditional instructional methods because such approaches overload their working memory with irrelevant or inaccessible information. Despite the recognized importance of inclusive education and the efforts made globally and nationally, science students with disabilities continue to experience poor academic outcomes. Research indicates that science students with learning disabilities consistently exhibit lower academic performance than their peers. This disparity is often attributed to challenges in cognitive processing, memory, attention, language development, and executive functioning in scientific reasoning, which can negatively affect learning, classroom participation, and academic achievement across various science subjects (Adjei et al., 2024; Gilmour et al., 2019). The challenges faced by these students are often compounded by inadequate support systems, limited access to specialized resources, and insufficient teacher preparation in inclusive science education practices. This challenge of poor academic performance of science students with learning disabilities is particularly evident in Adamawa State, where inclusive practices are still developing (Daily Trust, 2024). Although educational outcomes for science students with disabilities have improved nationally, many learners in Adamawa State continue to struggle academically due to limited access to appropriate learning support (Mahmud, 2017) however, special education in Adamawa state, faces numerous challenges including limited educational infrastructure, inadequate funding for special education, and insufficient trained personnel to support science students with learning disabilities. Several interrelated factors contribute to this ongoing underachievement. Financial constraints limit schools' ability to acquire, maintain, and update assistive technologies (Abdi et al., 2022). Infrastructural challenges, including unreliable electricity and poor internet connectivity, further restrict effective implementation (Nyumba et al., 2023). Additionally, many teachers lack adequate training in the use of assistive technologies, leading to underutilization even where tools are available (Okwudishu & Ibe, 2022). Sociocultural barriers such as stigma toward disability and low awareness among parents and educators also discourage adoption (Mwangi & Gitonga, 2023). Weak policy implementation, insufficient funding, and dependence on imported technologies that are poorly aligned with local curricula further reduce accessibility and effectiveness (Yusuf & Umar, 2022; Nyumba et al., 2023). Hardware-based assistive devices including tablets, specialized keyboards, voice-recognition software, and electronic worksheets have been shown to significantly enhance both engagement and academic performance among science students with learning disabilities, particularly in science education areas such as reading, and science related subjects (Scherer, 2017; Davis, 2020; Dixon, 2014). These devices provide alternative input and output methods that reduce physical and cognitive barriers to learning, allowing students to access instructional materials in ways that align with their individual abilities. Scherer (2017) explains that hardware assistive tools facilitate more effective interaction with science educational content by simplifying navigation, supporting writing, computation and enabling students to demonstrate understanding without being constrained by traditional paper-and-pencil tasks. Hardware assistive technologies encompass a wide range of physical devices designed to support learning. These include alternate keyboards with larger keys or keyguards designed for science students with motor impairments, enabling more precise typing; Braille displays and reading for students with visual impairments; speech-generating devices that help science students with communication difficulties; talking calculators that support mathematical computation; digital audio players for accessing recorded science content; and specialized computer systems with accessibility of abstract features. Low-tech hardware tools such as pencil grips, slant boards, and raised-line paper also play an essential role in supporting students with fine scientific skills challenges. Dixon (2014) emphasizes that hardware-based supports such as these increase student engagement by offering flexible and interactive learning experiences, particularly for learners who face physical challenges in addition to learning difficulties. Davis (2020) further notes that hardware-based supports promote independence by enabling science students to complete assignments at their own pace and with reduced reliance on external assistance. The use of hardware assistive technologies has also been associated with increased student confidence, active participation, and sustained academic engagement. When science students are provided with appropriate hardware tools, they experience reduced frustration and anxiety, which in turn fosters a positive attitude toward learning and academic achievement. The theoretical framework for understanding the role of hardware assistive technology in academic performance is provided by Cognitive Load Theory



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(CLT), developed by John Sweller (1988). CLT explains how the human cognitive system processes, stores, and retrieves information during learning. Cognitive Load Theory identifies three types of cognitive load: intrinsic, extraneous, and germane load. Intrinsic load relates to the inherent difficulty of the learning material itself; extraneous load arises from poor instructional design or unnecessary distractions; and germane load refers to the mental effort dedicated to processing, organizing, and integrating new information into long-term memory. The goal of effective instruction is to reduce extraneous load, manage intrinsic load, and optimize germane load. This theoretical framework provides a robust foundation for investigating the predictive relationship between hardware assistive technology and academic performance of science students in Adamawa state Nigeria. Several studies have shown that hardware assistive technologies can enhance academic performance and self-confidence among science students with learning disabilities by providing alternative and individualized means of accessing science subjects, (Griffiths & Tsimpli, 2015; Abdi & Omari, 2022). These tools support reading, writing, and problem-solving, enabling students to engage more actively and independently with learning tasks. Despite this evidence, the extent to which hardware assistive technologies are used in Adamawa State schools and their actual impact on students' academic performance remain unclear.

Statement of the problem

Given the persistent gap between the expected academic outcomes for inclusive education and the current reality of poor performance among science students with learning disabilities, several factors appear to contribute to this situation. Many science students with learning disabilities in Adamawa State have limited access to hardware assistive technologies, including physical devices, specialized equipment, and related support services. As a result, learners often struggle to cope with conventional instructional methods. Koh and Lee (2019) report that students who lack access to tools such as alternative keyboards, audio recorders, Braille displays, and other hardware resources frequently fall behind their peers, leading to academic stagnation. In addition, inadequate teacher training and inconsistent classroom use of available technologies further constrain effective learning support in Adamawa State.

Purpose of the study

This study seeks to examine

1. Whether the use of hardware assistive technology among science students with learning disabilities significantly predicts the academic performance of secondary schools in Adamawa State.

Research questions

The following research question was raised to guide the study:

1. What is the level of the use of hardware assistive technology of science students with learning disabilities in Adamawa State?

Null Hypothesis:

The following null hypothesis was formulated and tested at a 0.05 level of significance:

H₀₁: There is no significant prediction of hardware assistive technology on the academic performance of secondary schools science students with learning disabilities in Adamawa State.

Research Methodology

Correlational research design was used, enabled the researcher to make informed inferences about the relationships and predictive strength among the variables, thereby contributing to evidence-based practices in inclusive education. Area of the Study Adamawa State which is located in the North-Eastern part of Nigeria, the population of this study consisted of all 294 science students with learning disabilities in the four special education centers in Adamawa State. These include Special Education Center Mubi, Special Education Center Jada, Remi Education Foundation, and St. Monica Lutheran Academic Yola. Sample and Sampling Technique: From the population, a sample size of 133 science students with learning disabilities was used from Senior Secondary School 1 (SS1) to Senior Secondary School 3 (SS3) levels across four selected inclusive secondary schools in Adamawa State. The selection of participants was carried out using the purposive sampling technique, a non-probability method employed to ensure that only individuals who meet specific criteria relevant to the study were included. The criteria for inclusion were: (i) students formally identified or diagnosed with learning disabilities by qualified educational or medical personnel; (ii) students that offering science subjects currently enrolled in SS1 to SS3; and (iii) students who had been in their current school for at least one academic session to ensure sufficient exposure to any available assistive technology interventions. Instrument for data collection, two instruments were used for data



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collection in this study: a structured questionnaire and a student academic performance profoma. The questionnaire, titled Assistive Technology Questionnaire (ATQ). The ATQ consisted of sections including demographic information and a section on the use of hardware assistive technology with six items. Each item was rated on a five-point modified Likert scale, which measured the level of usage or exposure to assistive technology. The response options included: Very High Level (VHL = 5), High Level (HL = 4), Moderate Level (ML = 3), Low Level (LL = 2), and Very Low Level (VLL = 1). In addition to the questionnaire, a student academic performance profoma was used to obtain objective data on academic performance. This record included students' results in academic science subjects such as English Language, Mathematics, biology, chemistry, physics, obtained from the official school records of the third term. The data for this study were collected through the Assistive Technology Questionnaire (ATQ). The data were analyzed using descriptive and inferential statistics with the aid of SPSS version 25. Descriptive statistics such as mean and standard deviation were used to answer the research question. The decision rule for interpreting the mean scores followed the real limits: 4.50–5.00 = Very High Level (VHL), 3.50–4.49 = High Level (HL), 2.50–3.49 = Moderate Level (ML), 1.50–2.49 = Low Level (LL) and 0.50–1.49 = Very Low Level (VLL). Inferential statistics were used to test the hypothesis. Regression analysis was employed to determine the predictive strength of hardware assistive technology on the academic performance of science students with learning disabilities. This method was considered appropriate given the study's predictive correlational research design, which sought to examine the extent to which the independent variable (hardware assistive technology) predicted the dependent variable (academic performance). The regression analysis tested the formulated null hypothesis at a 0.05 level of significance to determine whether a statistically significant predictive relationship existed between hardware assistive technology use and academic performance.

Presentation of Results

Data Analysis and Presentation of Results

One research question was answered using descriptive statistics of mean and standard deviation. One null hypothesis was formulated and tested at a 0.05 level of significance using linear regression analysis.

Research Question 1: What is the level of the use of hardware assistive technology by science students with learning disabilities in Adamawa State?

Table 1: Mean and Standard Deviation of Level of the Use of Hardware Assistive Technology by Science Students with Learning Disabilities in Adamawa State

S/N	Item (n = 133)	Mean	S.D	Remark
1	Use of Braille keyboards enhances reading and writing performance	3.77	1.31	HL
2	Use of keyboard and mouse support improve computer driven learning	4.02	1.21	HL
3	Manipulation with computer navigates students with learning	3.85	1.26	HL
4	Students have access to libraries that improve learning	4.05	1.17	HL
5	Students with learning disabilities use talking Calculators	3.90	1.19	HL
6	Digital audio players are used for revision purposes during learning	3.99	1.15	HL
	Grand Mean	3.93	1.21	HL

The results in Table 1 indicate that the level of use of hardware assistive technology among science students with learning disabilities in Adamawa State is high, with a grand mean of 3.93 and a standard deviation of 1.21. The relatively moderate standard deviation suggests some variability in responses, but overall consistency in the perceived high usage. All items were rated high level (HL), with access to libraries (Mean = 4.05, S.D = 1.17) and use of keyboard and mouse support (Mean = 4.02, S.D = 1.21) ranking highest. Other tools such as Braille keyboards (Mean = 3.77, S.D = 1.31), talking calculators (Mean = 3.90, S.D = 1.19), and digital audio players (Mean = 3.99, S.D = 1.15). This implies that hardware assistive technologies are widely and reliably utilized.

H₀: There is no significant prediction of hardware assistive technology on the academic performance of secondary school science students with learning disabilities in Adamawa State.

Table 2: Summary of Regression Analysis Results for the Prediction of Hardware Assistive Technology on the Academic Performance of Secondary School Science Students with Learning Disabilities in Adamawa State

Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4290.029	1	4290.029	44.935
	Residual	12506.783	131	95.472	.000
	Total	16796.812	132		



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- a. Dependent Variable: performance
- b. Predictors: (Constant), Use of Hardware-Assistive Technology

The result in Table 2 revealed that hardware assistive technology significantly predicts the academic performance of secondary school science students with learning disabilities in Adamawa State, as indicated by $F(1,131) = 44.935, p < 0.05$. This implies that the regression model is statistically significant and that hardware assistive technology has a significant influence on science students' academic performance.

Discussion of Findings

The finding of the study revealed that hardware assistive technology is highly used among science students with learning disabilities in Adamawa State (Grand Mean = 3.93, S.D = 1.21) and significantly predicts their academic performance, $F(1,131) = 44.935, p < 0.05$. The null hypothesis was rejected, confirming that hardware assistive technology is a significant predictor of academic performance. This finding suggests that students in the study area have considerable access to and are actively utilizing hardware-based assistive tools such as keyboards, audio devices, Braille equipment, and other physical learning aids. It further implies that these tools are not merely available but are functionally integrated into the learning process in a way that enhances students' ability to engage with instructional content. The high level of usage observed for various hardware tools, particularly access to libraries (Mean = 4.05) and keyboard/mouse support (Mean = 4.02), suggests that schools in Adamawa State have made some investment in providing basic hardware resources. However, the moderate standard deviation (1.21) indicates that while usage is generally high, there is still some variation among science students, which may reflect differences in school resources, individual access, or personal preferences.

This finding agrees with the finding of Miller and Williams (2021), who reported that hardware-based assistive technologies significantly improved academic outcomes among students with learning disabilities. In their study conducted in Victoria, Australia, they found that hardware devices such as voice recognition software and reading tools led to significant academic improvements, with post-test scores averaging 74% compared to pre-test scores of 60%. The consistency of findings across different geographical contexts suggests that the benefits of hardware assistive technology are not culturally or contextually bound but are universally applicable. The finding is also in tandem with that of Miller and Stone (2019), who found that e-readers enhanced reading comprehension, thereby improving performance among students with learning disabilities in California. Their study reported that students using e-readers achieved mean post-test scores of 72% compared to pre-test scores of 55%, a significant improvement that supports the present study's findings regarding the effectiveness of reading-related hardware tools. In a similar vein, the finding corroborated that of Baker and Hall (2019), who observed that assistive tools such as graphic organizers improved students' writing performance in Canada. Their study found that students using graphic organizers achieved post-test scores of 74% compared to pre-test scores of 55%, reinforcing the idea that hardware tools supporting writing tasks can significantly enhance academic outcomes. Furthermore, the finding is consistent with the findings of Harris and Evans (2020) and Mitchell and Davis (2021), who established that interactive tools and augmented reality technologies significantly enhanced students' academic achievement. Harris and Evans reported post-test scores of 75% compared to pre-test scores of 58%, while Mitchell and Davis found post-test scores of 72% compared to pre-test scores of 50%, both demonstrating the positive impact of hardware-based interactive learning tools. This finding aligns with previous research emphasizing the importance of resource-rich learning environments for students with disabilities (Parette & Scherer, 2015; Kemp & Rogers, 2018). The high usage of keyboard and mouse support (Mean = 4.02) indicates that computer-based learning is prevalent in the study area, and adaptive input devices are being utilized effectively. This is encouraging, as computer-based learning offers multiple advantages for students with learning disabilities, including the ability to work at their own pace, access digital content, and utilize various software applications that support learning. However, the slight variability in the use of these different tools (standard deviations ranging from 1.15 to 1.31) suggests that not all students have equal access to all types of hardware. This may be due to cost constraints, limited availability, or lack of awareness among teachers and students about the available tools. This finding highlights the need for more equitable distribution of hardware assistive technologies across all special education centres and for ongoing awareness campaigns to ensure that students and teachers are aware of and can effectively utilize the available resources. The moderate level of academic performance observed among students with learning disabilities in this study (Mean = 62.25, S.D = 11.280) indicates that while progress is being made, there is still significant room for improvement. The noticeable variation in performance suggests that some students are benefiting



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more from available supports than others. This underscores the need for more targeted and individualized interventions that take into account each student's specific needs and learning profile.

Conclusion

This study concludes that hardware assistive technology is a critical determinant of academic performance among secondary school students with learning disabilities in Adamawa State. The hardware technological support and enhancing learning outcomes. The high level of usage of hardware assistive technology among students with learning disabilities in the state indicates that there is awareness of the importance of these tools, and efforts are being made to provide them. The findings underscore that when students are provided with appropriate hardware tools, The predictive strength of hardware assistive technology on academic performance (accounting for 25.5% of the variance) confirms that these tools are not merely supplementary but are meaningful contributors to student achievement. Furthermore, the finding that all six hardware items were rated at a high level suggests that there is a comprehensive provision of hardware supports in the study area. This is encouraging and indicates a commitment to inclusive education principles. However, the moderate level of academic performance observed (Mean = 62.25) suggests that while hardware assistive technologies are impactful.

Recommendations

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

1. Provision and Upgrading: Schools should provide and regularly upgrade hardware assistive technologies to improve students' academic performance.
2. Equitable Distribution: The Ministry of Education should ensure equal access to hardware assistive technologies across all special education centres.
3. Teacher Training: Teachers should be trained to effectively use and integrate hardware assistive technologies into classroom instruction.

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Qualitative Study on Digital Classrooms, Equal Futures: Artificial Intelligence-Powered Digital Pedagogy for Closing the Gender Digital Divide in STEM

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Abstract

The increase in Artificial Intelligence (AI), online learning platforms and virtual instructional technologies is definitely defining the possibilities for Science, Technology, Engineering and Mathematics (STEM) education. However, benefits of digital change are not equally shared. Girls and women still face difficulties regarding access to devices and connectivity, affordability, digital skills, confidence, gender stereotypes, safety and limited representation in STEM learning and careers. These differences are critical in Nigeria, where increase in digital education and AI creates opportunity to strengthen STEM participation but somewhat risks reproducing ongoing gender differences if technology is introduced without an explicit inclusion agenda. This paper investigates how AI-enhanced online and virtual STEM instruction can help to closing the gender digital divide, with attention to tertiary education and teacher education in Nigerian universities and colleges of education. The paper conceptualises AI-powered digital pedagogy as more than the use of generative AI tools; it incorporates adaptive learning, intelligent tutoring, learning analytics, virtual laboratories, automated feedback, AI-assisted content creation, collaborative platforms and AI literacy. The paper adds that these technologies can enhance accessibility, personalisation, feedback, participation and exposure to female STEM role models when they are fixed within gender-responsive pedagogy. However, AI can also reproduce gender bias, widen disparities through unequal shared access, compromise privacy and create new forms of exclusion. A gender-responsive AI digital pedagogy framework is further proposed, organised around six principles: equitable shared access, inclusive design, personalised learning, agency and voice, human-centred teacher support, and ethical accountability. The paper ends with recommendations for Nigerian tertiary institutions, teacher-education programmes, lecturers, policymakers and technology providers. It suffices that the objective should not merely place girls in digital classrooms, but to redesign digital classrooms so that girls can participate, belong, succeed and eventually lead in STEM.

Keywords: Artificial Intelligence, Digital Pedagogy, Gender Digital Divide, STEM Education, Girls and Women, Tertiary Education, Teacher Education, Online Learning, Inclusive Education

Introduction

Digital technologies are nowadays crucial to how knowledge is produced, taught, assessed and shared. The existence of Generative Artificial Intelligence (GenAI), intelligent tutoring systems, adaptive learning platforms, virtual laboratories and learning analytics has made this change faster. According to Jomen and Ayua (2026), and Miao et al. (2021) AI can enhance personalised learning, automated aspects of assessment, generate learning resources, provide feedback, identify learning difficulties and extend educational opportunities beyond the physical classroom. A Systematic review of Almasri (2024) reveals applications of AI in science education for creating learning materials, quizzes, assessment support, prediction and the enhancement of learning environments, and easing academic research if ethical concerns and guided against (Ayua & Kwagh, 2026). Perhaps these digital and AI-supported education is taking place within an unequal social environment. The digital divide is not a matter to be liken to whether a learner has an internet connection. It is more than just having an internet connection, it has to do with the ownership and quality of devices available, affordability of data for use, digital knowledge and digital skills, frequency and quality of use, confidence, resilience, safety, access to relevant content and the ability to convert digital access into function lasting educational outcomes for sustainability and stability in the ever-evolving world. It has been observed globally that men still have higher internet use more than women. Research shows that in 2023, with 70% of men compared with 65% of women using the internet space. This difference is noticeably much in Africa, where approximately four in ten men and three in ten women were internet users (International

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Telecommunication Union [ITU], 2023). This categorically shows that Nigeria gender dimension of digital transformation needs urgent attention. ITU (2023) adds that digital skills in Nigeria persistently shows gender disparity in computer literacy, with regional differences and noticeable gaps in some northern zones. Also, Ayua et al. (2026a, 2026b) found that male undergraduates demonstrate greater adoption and benefit more from AI chatbots in developing research skills than females; implying the potential of AI chatbots to enhance research competence is not being equitably realized across gender. Adding that, without targeted intervention, this gap may exacerbate existing inequalities in digital literacy and research productivity. This yawning gaps in digital divide shows that all stakeholders have to put hands on desk for proper and functional lasting solution for equal shared access to technologies. Moreso, World Bank (2025) revealed gender disparities in digital access, use and outcome in Nigeria, with the gaps being smaller among more educated and wealthier groups but still being noticeable among disadvantaged populations. The problem is more critical and important for STEM disciplines. Although women and girls have made a remarkable educational shift globally, however, they are still small in number regarding many STEM disciplines and careers. United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2024) shows that women are found only about 35% of STEM graduates globally, and this depict that women representation in STEM subjects like engineering, Information and Communication Technology (ICT) is weak. These differences therefore, show the existence of two disparities: gender disparity in STEM (Ayua, et al., 2026c) and gender disparity in digital participation (Ayua et al., 2026a, 2026b). Higher educations in Nigeria, could be a solution to provide crucial institutional site for intervention. Universities and colleges of education in Nigeria may be responsible not only for nurturing future STEM professionals but also for building teachers who can shape the STEM goals and digital experiences of future generations. This driving force of educational technology units, computer laboratories, learning management systems, internet facilities, digital libraries and online teaching platforms creates basis to which AI-enhanced pedagogy can be developed for equal shared participation. Nigeria's National Digital Learning Policy (NNDLP) shows that both the potential of AI for personalised learning and the risks is related with overdependence, biased content, privacy, cybersecurity and unsafe use (Federal Ministry of Education [FME], 2023). Nigeria's National Artificial Intelligence Strategy (NNAIS) place attention on developing AI-related skills among young people: an explicit target that at least half of the young people reached can be women (Federal Republic of Nigeria [FRN], 2024). This paper investigates a scheme that AI-powered digital pedagogy can become an instrument for bridging gender digital divide, instead of reproducing, the gender digital divide in STEM. The target is on tertiary education: universities, colleges of education and teacher-training programmes. This paper unravels gender and digital divide and digital pedagogy and gender inclusiveness, while contributing to discussions of teachers, professional development and preservice teachers' perceptions.

Conceptualising the Gender Digital Divide in STEM

Gender Digital Divide (G2Ds) could be viewed as a multidimensional phenomenon. A myopic view may term it as unequal shared access to computers or internet connectivity. A critical and creative thinker may view gender digital divide in four organised themes including: access, capability, use and outcomes.



Figure 1: Levels of Digital Divide



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The access divide as shown in Figure 1 explicate that women and girls particularly those in rural areas may lack availability, affordability of quality devices, electricity power supply, internet connectivity, software, assistive technologies, smartphones, laptops, broadband and technical support. Cost may maybe the major shackle, where girl learners depend on mobile data. A girl student may be online while relying on unstable mobile connectivity and an entry-level smartphone that cannot run data-analysis or simulation software. Formal availability can therefore mask functional exclusion. The capability divide has to do with digital literacy, information literacy, coding, computational thinking and AI literacy as shown in Figure 1. The usage divide shows gaps in skills, confidence, frequency, autonomy, resilience and the purposes for which technology is used. The usage divide explains where people who have access to technology and may use it for substantially, different purposes or with different levels of intensity. To access social media does not actually imply the ability to search academic databases, evaluate AI-generated claims, write codes, analyse datasets, protect personal information, or troubleshoot software. Dogra and Kaushal (2024) found that lack of digital skills are obstacles even after access is readily available, alongside economic limitations, sociocultural norms, workplace discrimination, and psychological barriers. The outcome divide shows whether technology use enhance educational achievement, employment, income, leadership, innovation, social participation, and personal agency. Outcomes divide, in which unequal digital participation produces unequal educational, economic and professional opportunities.

The Nigerian context demonstrates the importance of this multidimensional perspective. According to ITU (2023) assessment of Nigeria's digital economy identifies gender gaps in computer literacy and links digital inequality to poverty, low literacy, urban-rural disparities and disadvantages faced by women and girls. Students, maybe two can utilise a platform though, they may derive unequal benefits because one may have receive mentoring, recognition, and career opportunities while the other could have encounters stereotyping, harassment, or low expectations. All of these categories of digital inequality interact. Poor or weak connectivity can limit opportunities to enhance advanced skills; limited skills reduce confidence; low confidence can suppress participation; reduced participation leads to weaker outcomes; and weaker outcomes can reinforce beliefs that women are less suited to technology. Closing the gender digital divide therefore requires more than distributing devices. Institutions must cultivate meaningful, autonomous, safe, and productive participation. United Nations International Children's Emergency Fund (UNICEF) reveals that girls have limited access to digital devices and may need to borrow devices from family members or friends; nevertheless, when access is available, girls use digital technologies for educational purposes (UNICEF Nigeria, 2024). This dissimilarity is vital because by making available a computer laboratory does not assume gender equality. A girl may have access to a computer but lack confidence and resilience in programming; she may possess a smartphone but have inadequate data or broadband; she may participate in an online course(s) but may still be silent because of gender stereotypes; or she may use an AI tutor but receive biased or culturally inappropriate responses. The digital divide can also relate with the STEM contribution pipelines. Gender disparities can be more as girls advance through educational systems. A girl student who receives little or no exposure to technology, has few female STEM role models and encounters gender stereotypes may not want to select technology-intensive courses at higher education. At higher education, insufficient provision may add the probability of withdrawal from STEM programmes. Gender gap in higher STEM education according García-Holgado et al. (2022) found that stereotypes, stereotype threat and the educational and social environment are significant influences on STEM decision-making, while positive self-concept, self-reliance, resilience, confidence and self-efficacy are important for encouraging participation in STEM decision-making. Musso et al. (2022) has also connected STEM gender stereotypes with students' school experiences, empowerment and engagement. This explains that bridging gender digital divide demands more than connectivity. It needs a holistic change of educational experiences through which girls can encounter technology, STEM knowledge and their own identities as potential STEM professionals.

AI-Powered Digital Pedagogy

AI-powered digital pedagogy refers to integration of Artificial Intelligence (AI) into teaching and learning processes in ways that may improve learning, personalisation, inclusion, assessment, interaction and learner agency. This should not be equated to as permitting students to use ChatGPT, Gemini, Copilot and the likes.

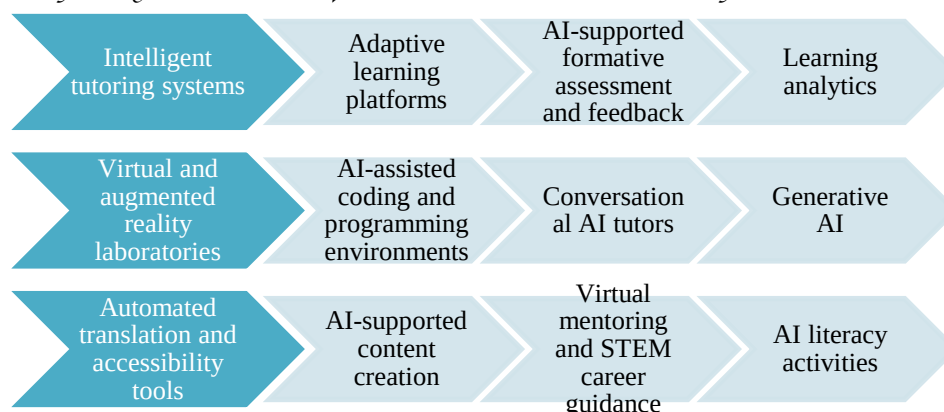


Figure 2: AI-powered digital pedagogy

Figure 2 reflect AI-powered digital pedagogy: intelligent tutoring systems which can provide individualised guidance; adaptive learning platforms which may adjust content to learners' progress; AI-supported formative assessment and feedback; learning analytics that could identify students who may require additional support; virtual and augmented reality laboratories; AI-assisted coding and programming environments; conversational AI tutors; generative AI which may help for brainstorming, explanation and simulation; automated translation and accessibility tools; AI-supported content creation; virtual mentoring and STEM career guidance; and AI literacy activities that students can critically observe how AI works and how it affects society. The educational worth creation of AI depends on pedagogy instead of technology only. Miao et al. (2021) lament that AI in education should support human-centred approaches, inclusion and equity instead of replacing teachers or reproducing existing differences. Digital Education Outlook: AI, learning analytics, robotics and other smart technologies can enhance personalisation and inclusion however, they need appropriate institutional, pedagogical and policy conditions (Organisation for Economic Cooperation and Development [OECD], 2021). The importance of AI literacy in education cannot be overemphasized as Casal-Otero et al. (2023) posits that AI literacy incorporates more than just technical knowledge and it may help learners comprehend better and interact critically and creatively with AI systems. Ng et al. (2022) view AI literacy as an emerging field and stressed the need for clearer explanations, pedagogical structures and assessment approaches. As higher institutions in Nigerian, AI may become integral part of the pedagogical ecosystem instead of an isolated technological add-on. For a good illustration a science teacher may learn not only how to ask an AI system to generate a chemistry lesson, however, it can also ask how to verify the scientific accuracy of the output, identify gender stereotypes in the examples provided, protect students' data and adapt the material to the Nigerian education setting.

Why AI-Powered Digital Pedagogy Can Benefit Girls in STEM

Here are the reasons to which AI-Powered Digital Pedagogy can benefit girls in STEM disciplines.

1. Personalised learning and differentiated support

A vital potential merit of AI in STEM education is the ability to promote personalised learning, because STEM courses can have cumulative knowledge structures including complexities in algebra that can affect physics; weak basic programming which may affect computer science; misconceptions in chemistry that could affect later learning. AI-supported platforms can enhance additional explanations, practice exercises, hints and feedback according to a learner's performance. This can be beneficial to students who are unwilling to ask questions in the public, unlike in a conventional classroom where a woman or girl student who may be fearful for being evaluated for making mistakes can remain silent. An AI tutor can pave way for a low-stake platform for recurrent inquiries. Technology has the strength to reduce social cost of making mistakes. Deng et al. (2024) lament that generative AI can enhance some dimensions of learning and ChatGPT, copilot or Gemini may have positive effects on academic performance and higher-order-thinking tendencies, however, the investigation did not find a corresponding improvement in self-efficacy. The finding is so critical for gender-responsive pedagogy in that technology can enhance performance without necessarily addressing confidence, resilience and identity. This means that human teachers may therefore, join AI-supported learning with encouragement, mentoring and opportunities for visible achievement.



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2. Flexible access to STEM learning

The online and virtual learning can minimize boundaries related with time, distance, type of school and physical location. The students who may face transport challenges, family responsibilities or safety concerns, access to recorded lectures, digital simulations and online discussion forums may promote valuable flexibility. It is good to note that flexibility should not at all be confused with equity. If online learning adopts broadband regularly, individual laptops and uninterrupted electricity power supply, it can precisely advance the students it is intended to support. Gender-responsive online pedagogy can adopt low-bandwidth and mobile-friendly approaches. Groupe Spécial Mobile Association (GSMA, 2024) maintains that mobile technologies are important routes to internet access in low- and middle-income countries, but women still face problems to mobile ownership and use. This means that there is need for higher education in Nigeria to design digital STEM resources that can function through mobile devices, compressed video, downloadable materials, asynchronous discussion and offline access where possible.

3. Virtual laboratories and simulation

Real-life STEM education can be costly where laboratories are poorly equipped. Virtual laboratories and simulations can balance real-life laboratories by allowing students to observe procedures, manipulate variables and visualise concepts before undertaking real experiments. Regarding female students who may have limited opportunities to use specialised equipment, virtual platforms can help them to practice in such opportunities. AI can as well personalise such platforms by adjusting learning tasks to suit students' performance. Considering this for instance, a virtual physics laboratory could allow students to examine gravitational force, projectile motion, electric circuits or fluid dynamics. An AI tutor can ask questions to identify misconceptions and recommend students to another simulation. A virtual chemistry laboratory can also allow students to perform repeated experimentation without intense use of expensive reagents. It is however good to note that virtual laboratories should not replace or take over physical laboratories, instead, it can only phase out boundaries for more practice and as well prepare students for effective physical experiments.

4. Paving way for access to female STEM role models

Girls' ambassadors in STEM cannot be overemphasized, because girls who may not see women as Engineers, Computer Scientists, Mathematicians, Biologists, Chemists, or physicists may find it difficult to envision themselves in such careers. Undoubtedly, digital classrooms can improve access to female STEM professionals more than the geographical limitations of a physical classroom. Nigerian higher institutions can build "Virtual Women in STEM" seminar series involving women working in engineering, virology, medical physics, artificial intelligence, medicine, cybersecurity, renewable energy, data science and educational technology. AI-enabled environments can then join students' interests, and attitudes with vital career pathways. Gladstone and Cimpian (2021) asserts that STEM role models' effects depend on perceived competence, similarity and attainability, rather than presenting famous women as exceptional figures. Students in Nigeria may therefore, benefit from experience to applicable female STEM professionals who may explain everyday trails into STEM, like setbacks, family errands, financial limitations and strategies for overcoming boundaries in STEM.

5. Supporting collaborative learning

It is good to also note that digital pedagogy should not in any way turn learning into a lonely interaction between a student and a machine. Collaboratively learning is still vital for STEM identity and belonging. Kube et al. (2022) confirms that potential collaborative learning platforms can reduce gender stereotypes and promote inclusive participation, however their study cautioned that gender is often treated mere as a binary variable. AI can promote such collaboration by conveying mixed teams to authentic STEM problems, facilitating brainstorming, identifying unanswered questions and providing feedback. Teachers or lecturers can monitor participation patterns to make sure that male students don't unduly assume technical or leadership roles while female students are allotted note-taking or presentation-support roles.

6. Improving accessibility

There are AI platforms that can also support learners through translation, speech-to-text, text-to-speech, captioning, summarisation and other accessibility functions. These technologies can lessen linguistic and communication boundaries. Accessibility in higher education in Nigeria can also include sensitivity to local language practices, bandwidth restrictions and different levels of digital literacy. A gender-inclusive AI system cannot assume that all learners are technologically confident or that English-language interfaces are equally accessible to everyone.

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7. Digital Pedagogy and Gender Inclusivity

The gender-inclusive digital pedagogy needs attention to who participates, who speaks, who leads, whose experiences appear in learning materials and who benefits from technology. A gender-neutral approach means that technology is available to all, also a gender-responsive approach questions who can actually use it, under what conditions, for what purposes, and with what outcomes? This discrepancy is fundamental because technology may appear neutral while operating within unequal social conditions. UNESCO (2024) confirms that technology can help girls who can be excluded from conventional education, but digital disparities and gender stereotypes can also be reproduced through technological design and use. It is clear that AI can replicate gender bias because AI systems learn from social data that may already contain unequal representations (United Nations Entity for Gender Equality and the Empowerment of Women [UN Women], 2024). Thus, gender-inclusive digital pedagogy should address five pedagogical questions as shown in Figure 3.

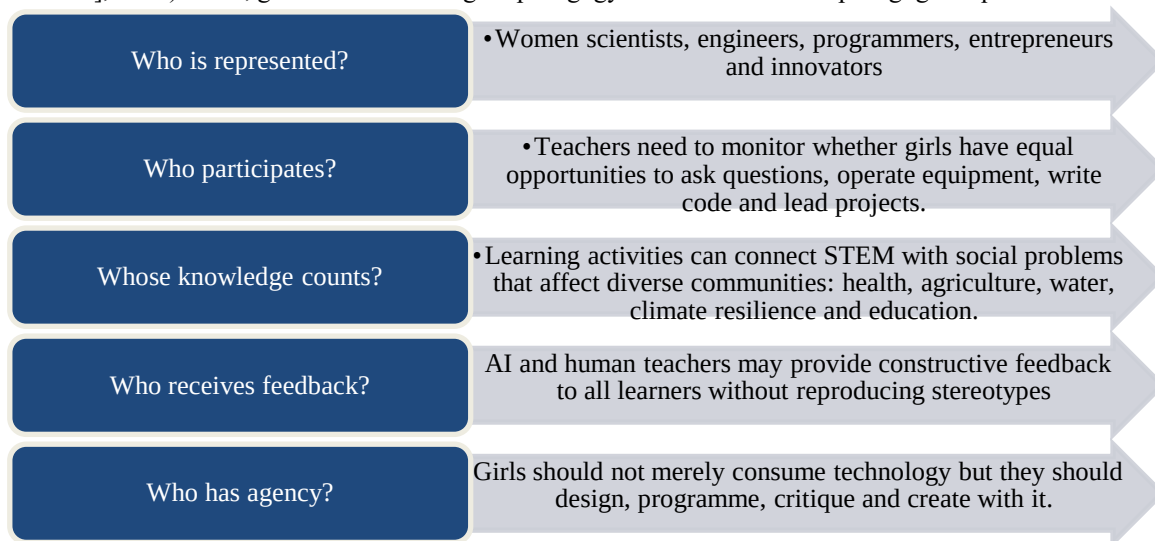


Figure3: Five Pedagogical questions Gender-Inclusive Digital Pedagogy can Adress

The Place of Nigerian Tertiary Education

It is captivating for locating this plan within Nigerian tertiary education. It is vital to note that universities and colleges of education in Nigeria provide institutional structures through which digital pedagogy can be integrated into formal preservice teachers. Science education, technology education, entrepreneurship education, computer science, engineering, mathematics education and educational technology programmes can set in AI literacy and gender-responsive pedagogy within an existing curriculum. Higher educations in Nigeria stand a greater chance to affect both present learners and future generations. A female undergraduate who becomes a science teacher may teach hundreds or thousands of learners. Thus, gender-responsive digital pedagogy in teacher education has a multiplier effect. Tertiary education in Nigeria may have access to learning management systems, computer facilities, internet-enabled classrooms, digital libraries and educational technology expertise. However, access is still uneven problem in Nigerian tertiary institutions, thus, making institutional savings and equity-sensitive practice is essential. There is an indication of growing student awareness of generative AI. Ezurike and Akinsulire (2024) confirms that undergraduates in Lagos reported substantial awareness and adoption of ChatGPT as a learning tool, with students identifying personalised learning and assistance with understanding complex concepts among its perceived benefits. It means that the question facing tertiary institutions in Nigeria is not whether students have encountered AI, but it is how institutions may guide that encounter. Nigeria's policy environment is being supportive of digital and AI development as shown by Federal Ministry of Education ([FME], 2023) that National Digital Learning Policy recognises AI's capacity to personalise learning while explicitly identifying concerns about bias, overdependence, privacy, cybersecurity and learning outcomes. Furthermore, the National AI Strategy has places human capital development and AI skills among its priorities and explicitly incorporates women into its youth-skills ambitions (FRN, 2024). Nigerian tertiary education therefore, epitomises appropriate joint for gender policy, digital transformation, teacher education and STEM development.

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AI-Powered Digital Pedagogy Framework for Gender-Inclusive STEM

The Gender-Inclusive AI Digital Pedagogy Framework (GI-AIDP) for STEM education in Nigeria. This framework is built around six equally strengthening philosophies.

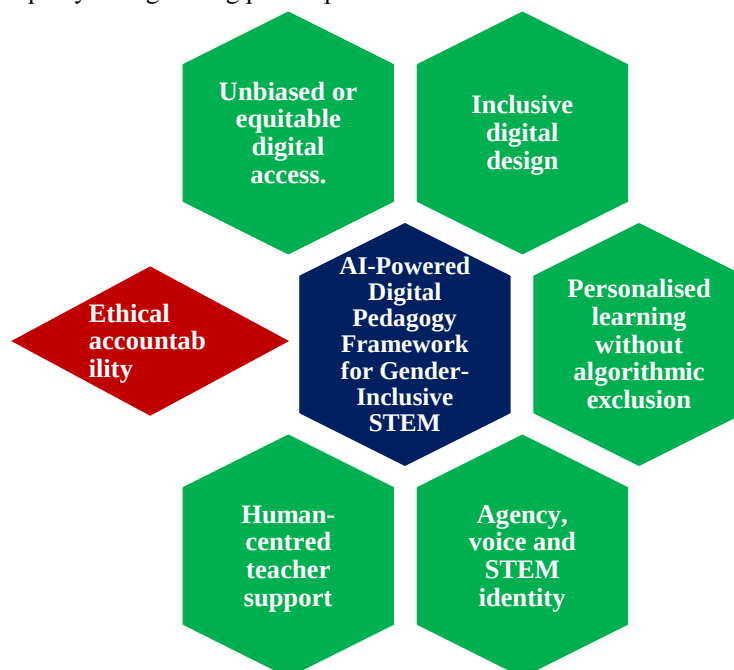


Figure 4: Gender-Inclusive AI Digital Pedagogy Framework (GI-AIDP) for STEM education in Nigeria

Philosophy 1: Unbiased or equitable digital access.

AI alone cannot bridge digital divide except all students can access it. This means that Nigerian tertiary institutions may provide the following: device-loan schemes, affordable or subsidised connectivity, campus Wi-Fi with gender-equitable access, charging facilities and alternative power supply solutions, computer laboratories with extended hours, downloadable and offline learning materials, mobile-compatible learning platforms, and targeted digital support for demerit female students. This focus is not only access to hardware but it has to do with meaningful and sustained access to educational technologies.

Philosophy 2: Inclusive digital design

Tertiary education system in Nigeria can make available digital STEM resources designed for all learners. Course designers may consider prior digital experience, cognitive load, accessibility, screen size, bandwidth and language. Instructional materials can intentionally involve women and girls as STEM creators instead of portraying them only as recipients of technology.

Philosophy 3: Personalised learning without algorithmic exclusion

Here AI systems can identify yawning gaps in learning and may recommend resources. However, Tertiary institutions in Nigeria could monitor whether algorithms create scientifically different recommendations for male and female learners. Adaptive system for instance may not interpret lower initial confidence among female students as evidence that they are less capable of advanced STEM work, instead, it can provide scaffolding while sustaining high opportunities.

Philosophy 4: Agency, voice and STEM identity

Nigerian tertiary institutions can ensure that students use AI to create instead of consuming. Gender-inclusive STEM activities can include girls in the following aspects programming, robotics, data analysis, AI model critique, scientific simulations, engineering design, digital storytelling, problem-based learning, innovative digital modelling, and entrepreneurship. AI could be situated as a tool that girls can control, handle, manipulate, question and redesign.

Philosophy 5: Human-centred teacher support

Lecturers and teacher educators can note that AI may only augment and not replace them. It is noticeable that human teachers are integral components for mentoring, emotional support, contextualisation, ethical judgement and the development of STEM identity. Lucas et al. (2021) posits that digital competence is influenced by confidence, resilience,

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openness to technology and the range of digital tools used in teaching. Also, digital competence should be treated as a multidimensional professional capacity rather than a simple technical skill (Basilotta-Gómez-Pablos et al., 2022). This means that NCE, B.Ed., M.Ed. and PhD programmes can be incorporated with practical AI pedagogy by Nigerian higher institution instead of limiting AI to theoretical discussion.

Philosophy 6: Ethical accountability

Universities and colleges of education should ensure that AI-supported education must protect students from privacy violations, discrimination, surveillance, and unsafe online platforms. The ethical dimension is vital for girls because digital participation may expose them to harassment, gender-based abuse and other forms of online violence. UN Women (2024) highlighted how AI can intensify gender-based digital harms. Thus, Nigerian universities and colleges of education may establish clearer policies regarding students' data protection, consent, academic integrity, AI-generated content, algorithmic bias, cyberbullying, online harassment, deepfakes, responsible use of generative AI, and procedures for reporting digital abuse (Ayua & Akaabo, 2016; Ayua, 2018; Ayua & Kwagh, 2026).

A Real-Life Model for Universities and Colleges of Education in Nigeria

This real-life model framework can be organised and operationalised in four-stage institutional model.

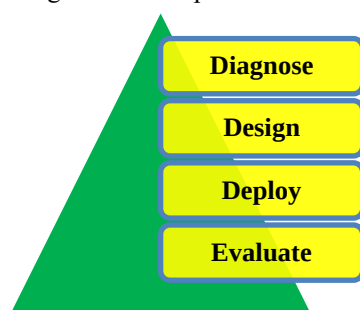


Figure 5: Real-Life Model Framework Stages

Stage 1: Diagnose

Universities and colleges of education can conduct gender-disaggregated audits in the following areas: STEM enrolment, device ownership, access to laboratories, internet access, digital skills, AI literacy, course completion, participation in online activities, academic performance, and students' confidence in technology usage. The purpose this audit is to identify and locate where this gender digital divide occurs.

Stage 2: Design

Courses could be redesigned in tertiary institution in Nigeria around gender-responsive digital pedagogy. Like in the instance of physics courses, it can contain video lectures, AI tutoring, virtual simulations, collaborative problem-solving and mentoring by female physicists. Computer science courses for example may use AI coding assistants meanwhile requiring students to explain, test and critique AI-generated code. This could prevent AI from being just a shortcut but turning it into a tool for computational thinking. Teacher-education programmes in Nigerian institutions can require preservice teachers to design AI-supported STEM lessons explicitly addressing gender inclusion.

Stage 3: Deploy

Nigerian universities and colleges of education can practice combined technology with human support. Female students in the universities and colleges may have access to the following: female STEM mentors, peer-learning groups, digital-skills clinics, AI-literacy workshops, coding and robotics clubs, research opportunities, virtual STEM communities, and academic advising counsellor. This approach is consistent with García et al. (2020) that sustained interventions combining inclusive pedagogies and role models are more advantageous for strengthening girls' STEM identity than isolated exposure.

Stage 4: Evaluate

Evaluation can go beyond just counting the number of students who logged into online platform. Nigerian universities and colleges of education can ensure full participation rates by gender, retention in STEM programmes, course achievement, AI literacy, digital confidence, digital resilience, STEM self-efficacy, STEM identity, progression to postgraduate study, participation in STEM research, technology entrepreneurship, and perceptions of belonging and inclusion. It is good to note that gender-disaggregated data are essential and without them, tertiary institutions in Nigeria may declare a digital initiative successful but girls may still remain disproportionately excluded.

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Implications for Teacher Preparation and Professional Development

The vital part of this study to NCE, B.Ed., M.Ed. and PhD Science Education programmes is actually good, because teacher educators can prepare preservice teachers to perform task at least in six roles as shown in Figure 5.

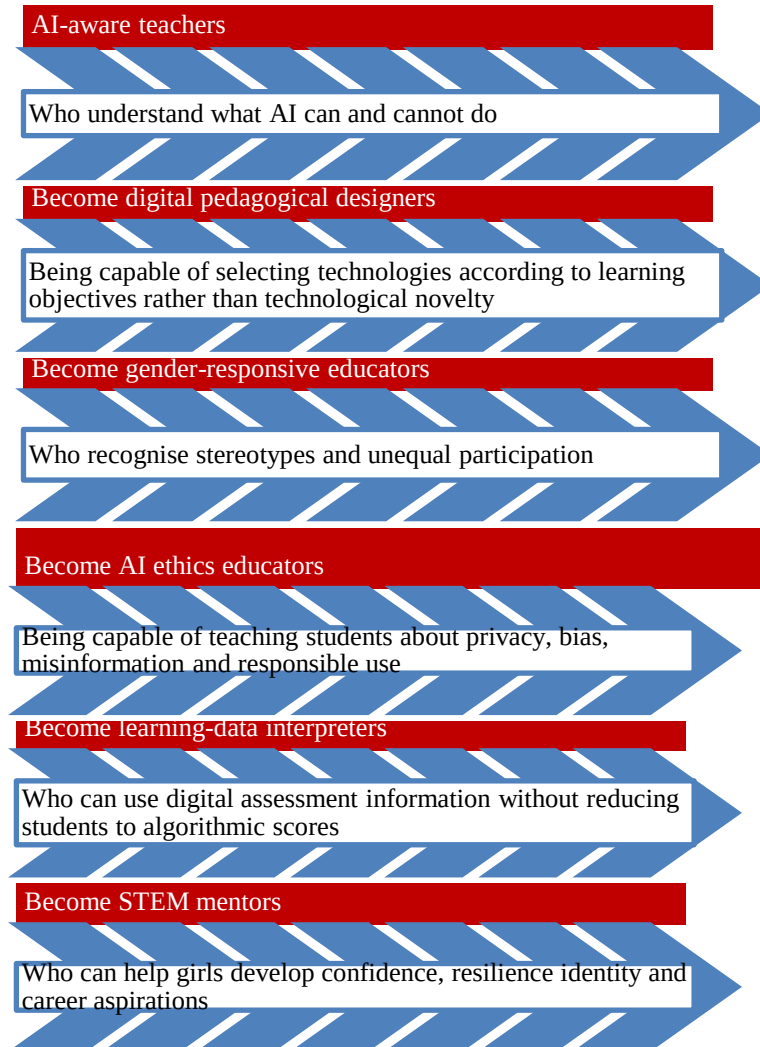


Figure 5: Roles of Teacher Preparation and Professional Development

These roles shown in Figure 5 needs professional development for Nigerian educators to move beyond one-off workshops. The digital competence can only be developed through practice, reflection and supporting experimentation. Reisoğlu and Çebi (2020) shows the importance of collaborative learning, role modelling and opportunities to put theoretical knowledge into practice. Therefore, teacher educators can establish AI pedagogical laboratories where preservice teachers can design, test and evaluate digital lessons. Such AI pedagogical laboratories can have the following: generative AI tools, virtual laboratory platforms, coding platforms, robotics kits, learning analytics dashboards and accessibility technologies. Viewing the vital aspects of this, professional development itself may be gender-responsive where female teacher educators and preservice teachers can be encouraged to accept leadership roles in institutional AI initiatives instead of being positioned only as beneficiaries.

Opportunities and Risks of Generative AI for Gender Equality

Generative AI reveals an integral inconsistency where it can democratise access to expertise while concurrently reproducing social disparities. A student can obtain explanations of complex mathematical, Biological, Chemistry or Physics concepts, receive programming assistance, generate practice questions or simulate a scientific discussion without waiting for a lecturer, this is an opportunity on the side of learners. This can be vital in large class sizes with limited instructor time. However, most times AI-generated information may be inaccurate, biased or stereotypical. Miao et al.



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(2021) confirms that AI systems can reproduce bias and that educational AI requires transparent, fair and inclusive governance. Gender bias in AI can reflect broader social disparities, also a greater participation by women in AI advancement is critical (UN Women, 2024). The problem of automation disparity is also a risk, because students with quality devices, stronger digital skills and more experience writing prompts may gain greater more from GenAI than students who are new to technology. Academic dependency is another risk to ponder upon, because if students could just copy AI-generated answers, they may complete assignments without developing scientific reasoning, critical thinking. FRN (2023), Jomen and Ayua (2026), confirm that excessive dependence on AI could weaken critical thinking, creative thinking and problem-solving of learners. The proper response to this is not to stop AI usage, however, learners can be taught how to use it critically. Regarding gender-responsive AI assignment might require students to do the following tasks: asks AI system to generate a solution, independently solve the problem, compare the two responses, identify errors or assumptions, examine potential gender or cultural bias, improve the AI response; and reflect on what the exercise reveals about AI. This can transform AI from a replacement for thinking into an object and instrument of creative and critical thinking.

Call for action in Research Agenda for Nigeria

There is need for gender-disaggregated research on AI adoption in Nigerian tertiary education system. Awareness of ChatGPT, copilot or Gemini does not really mean equitable or educationally productive use. Research can examine AI literacy among female preservice teachers. Studies may ask whether female and male preservice teachers differ in confidence, critical understanding, perceived usefulness and ethical awareness. Researchers could investigate AI-supported STEM retention. The critical outcome is not just whether girls use AI but whether they remain in STEM programmes and advanced into STEM careers. Researchers can investigate algorithmic bias in educational AI used in Nigeria. AI systems trained predominantly on non-African data may provide examples, explanations and assumptions that do not adequately reflect Nigerian learners. There is a need for intersectional research. Gender cannot be studied in isolation from poverty, disability, rurality, language, ethnicity, geographical location and socioeconomic status. Longitudinal research can examine whether AI-enhanced digital pedagogy changes STEM identity, resilience and self-efficacy. This is vital because learning performance and identity development may not have identical outcomes. Researchers may investigate into teacher professional development models that can sustainably integrate AI and gender-responsive pedagogy within universities and colleges of education in Nigeria.

Conclusion

The future of STEM education can be digital, intelligent and interconnected. The central question is not whether AI can enter the Nigerian classrooms, it has already entered. The vital question is whose educational opportunities may expand as AI has surrounded teaching and learning. AI-powered digital pedagogy has unique and novel potential to make STEM education more accessible to girls and women: personalised learning can promote additional support, virtual laboratories can expand opportunities for experimentation, online platforms can remove some geographical boundaries, AI-enabled accessibility tools can support individual differences, and digital mentoring can connect girls with women STEM professionals. We can still say that technology is not inherently inclusive. Without attention to intervention, AI can reproduce the gender stereotypes, unequal access and social exclusions which already exist in education. The gender digital divide cannot be merely solved by putting more computers in classrooms or making ChatGPT, copilot or Gemini available to students. The most integral part is gender-responsive digital change. It simply means integrating AI literacy, digital pedagogy, STEM mentoring and gender inclusiveness into universities and colleges of education in Nigeria. It means developing NCE, B.Ed., M.Ed. and PhD students to become teachers and researchers who can use AI critically and ethically. Moreso, designing digital learning environments in which girls are not passive consumers of technology but programmers, researchers, designers, problem-solvers and innovators. Gender-Inclusive AI Digital Pedagogical Framework rests on six philosophies: equitable access, inclusive design, personalised learning without algorithmic exclusion, learner agency, human-centred teacher support and ethical accountability. Collectively, these philosophies shift the focus from technological adoption to educational change. The core aim can be expressed not as AI for girls, but as AI with girls, by girls and for equitable STEM future. Digital classroom instruction can become equalising spaces but only when equality is intentionally designed into the technology, pedagogy, curriculum, teacher development and institutional policies that shape them. Regarding Nigeria, this has represented educational responsibility and opportunity to ensure that the country's transition into an AI-driven economy does not lock women and girls behind the door.



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Policy and Institutional Suggestions

The following are to be considered here.

1. Nigerian universities and colleges of education should develop institutional AI-and-gender strategies instead of adopting AI tools on an ad hoc basis. All digital-learning strategy should comprise gender-equity indicators. Tertiary educations in Nigeria should create device-loan structures and targeted digital-skills programmes for female students from challenged backgrounds. They should advance campus-based AI and STEM mentoring programmes to be headed by female academicians, researchers and industrial professionals.
2. Teacher-education should ensure to incorporate the following into her curricula: AI literacy, digital pedagogy, computational thinking, virtual STEM laboratories, gender-responsive teaching, algorithmic bias, digital citizenship, cybersecurity, data privacy, and responsible generative AI use. The target should be to produce teachers who can teach with AI, about AI and against the harmful uses of AI.
3. Government should prioritise affordable broadband, reliable electricity, digital devices and inclusive AI infrastructure. Digital-skills initiatives should collect gender-disaggregated data so that progress can be monitored. Nigeria's National AI Strategy provides an important policy foundation because it explicitly recognises youth AI skills and includes women within its human-capital objectives.
4. Technology providers of AI and educational-technology companies should involve women educators and STEM education experts in design and testing. Systems should be assessed for gender bias, language accessibility, cultural relevance, privacy and safety.
5. Nigerian research institutions should undertake longitudinal studies examining whether AI-supported interventions actually improve girls' STEM retention, achievement and career progression. Current literature contains substantial evidence on AI and education generally, but much less evidence directly examining gender-responsive AI pedagogy in African tertiary STEM education settings.

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Qualitative Study on Human-Centered Artificial Intelligence Frameworks for Mitigating Systemic Inequalities in Workforce: A Review

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Abstract

The proliferation of artificial intelligence (AI) and algorithmic architectures within structured human resource environments has raised serious concerns about the digital amplification of systemic bias and intersectional inequalities. This paper presents a systematic literature review of peer-reviewed articles published between 2020 and 2026 focusing on Human-Centered AI (HCAI) frameworks engineered to safeguard and promote workforce equity. Moving beyond standard data-centric mitigation strategies, this review synthesizes scholarship across management sciences, sociology, and computational ethics to analyze how algorithmic inequality regimes are constructed and subsequently dismantled. The review demonstrates that standalone technical bias-correction algorithms fail to mitigate historically embedded institutional discrimination unless coupled with robust human-in-the-loop oversight, ethical compliance auditing, and explicit regulatory accountability. Synthesizing contemporary literature, this study presents an integrated governance framework for organizational practitioners to proactively eliminate systemic demographic barriers while maximizing technological utility within corporate ecosystems.

Keywords: Human-Centered AI, Systemic Inequality, Workplace Equity, Ethical Human Resource Management.

Introduction

The exponential adoption of artificial intelligence (AI) and automated decision-making systems (ADMS) has fundamentally transformed global labor infrastructure. Organizations increasingly utilize advanced algorithmic applications across critical employment nodes, including programmatic sourcing, candidate screening, automated performance evaluation, and predictive attrition modeling (Hughes et al., 2026; Wowledge, 2026). While early tech adoption narratives claimed algorithms would eliminate subjective human prejudice and promote scientific objectivity, empirical scholarship published between 2020 and 2026 has robustly deconstructed this techno-optimistic paradigm. Instead, data science researchers and organizational sociologists have established that automated tools frequently act as "algorithmic gatekeepers," codifying and amplifying historically embedded socioeconomic, gender, and racial prejudices into sophisticated software protocols (Amis et al., 2020; Kim, 2020). The realization that digital tools can systematize institutional discrimination has forced a paradigm shift in Human Resource Management (HRM). Conventional algorithmic models focus almost exclusively on mathematical optimization and operational efficiency, reducing human capital dynamics to mathematical coordinates. In response, a multidisciplinary research domain has championed Human-Centered AI (HCAI) frameworks (Mabrouk, 2026). HCAI frameworks redefine technology design by mandating that software architectures must prioritize human autonomy, ethical transparency, systemic equity, and social responsibility alongside standard technical functionality. Consequently, a comprehensive literature review exploring the implementation of HCAI architectures to actively mitigate systemic workforce inequality is essential for contemporary management scholars and strategic organizational practitioners alike.

Conceptualizing Algorithmic Inequality Regimes

To understand the remedial role of HCAI frameworks, it is first necessary to evaluate how systemic inequalities manifest in digital environments. Drawing on Acker's (2006) foundational concept of "inequality regimes," contemporary organizational theorists have expanded this definition to incorporate software-driven processes. Hughes et al. (2026) define algorithmically mediated inequality regimes as interconnected systematic structures of discrimination built directly into the data models, features, training criteria, and evaluation mechanisms of automated human resource applications. Empirical analyses reveal that digital bias emerges primarily from historical training data. Because machine learning models are trained on historical datasets, they inherently internalize existing social disparities. For example, if historical corporate selection data reflects an underrepresentation of female engineers due to historic societal prejudices, automated resume screening engines will mathematically amplify this variance, interpreting female demographic indicators as predictors of poor corporate performance (Kim, 2020). Beyond data bias, additional structural imbalances arise from the operational execution of "algorithmic management" where autonomous algorithms continuously monitor, track, and score



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employees without clear recourse or transparent explanation (Fayyaz, 2026; Riordan, 2025). This lack of transparency disproportionately impacts marginalized worker cohorts who are clustered in platform-mediated or precarious work environments characterized by high surveillance and minimal institutional protections (Chatterjee & Jemima, 2025).

The Human-Centered AI Paradigm: Core Tenets

Human-Centered AI shifts the focal point of system design from autonomous automation to collaborative augmentation. Rather than designing technology to replace or uncritically evaluate human employees, HCAI mandates that algorithmic tools operate as support systems that amplify human potential while honoring ethical constraints (Mabrouk, 2026). The literature identifies three core pillars of HCAI within modern workplace environments:

1. Explainability and Transparency (XAI)

Traditional deep-learning systems function as opaque "black boxes," leaving both HR professionals and prospective candidates unaware of why specific personnel decisions were mathematically generated. HCAI frameworks require the integration of Explainable Artificial Intelligence (XAI) protocols. This operational shift provides stakeholders with transparent, legible explanations regarding the specific features and weights driving an automated decision, which is a core corporate governance requirement under the EU AI Act (Fernandez & Jenkins, 2025).

2. Human Agency and Oversight (Human-in-the-Loop)

HCAI strictly rejects fully autonomous, unmoderated machine decision-making for high-stakes employment outcomes such as hiring, performance disciplinary tracking, and terminations. The framework mandates that a human expert must maintain ultimate decision authority, leveraging the algorithm as an advisory asset rather than a final arbiter (Stone & Deadrick, 2025). This structure acts as a vital buffer against computational anomalies and structural algorithmic errors.

3. Fairness, Accountability, and Safety (FAS)

HCAI explicitly includes ethical metrics directly into the software lifecycle. Systems must pass routine statistical parity and disparate impact assessments to verify that selection ratios do not display bias against protected demographic cohorts (Boudreau, 2024).

Frameworks For Mitigating Inequality: A Synthesis

The scholarship between 2020 and 2026 offers distinct strategic models for embedding HCAI within organizational talent lifecycles. Researchers split these mitigation frameworks into three key operational levels: technical preprocessing interventions, continuous internal procedural governance, and external macro-level regulatory compliance frameworks.

Technical and Data-Level Preprocessing Frameworks

At the technical level, computer scientists and people analytics researchers emphasize the importance of data sanitization and adversarial training regimes. Rahmawati and Rahmat (2024) document how leading technology institutions utilize debiased training models that proactively strip out explicit and implicit demographic features (such as postal codes or names of single-sex colleges) before datasets are fed into automated recruitment models. Furthermore, modern frameworks deploy adversarial machine learning techniques, where a secondary algorithmic supervisor continuously checks the main model to ensure its predictions remain independent of protected class variables (Al-Mansour, 2025).

Procedural Governance and Internal HR Audits

Technology alone cannot rectify socio-technical errors. Organizational theorists argue that technical interventions must match thorough internal procedural governance. Marler and Boudreau (2024) argue for the establishment of cross-functional "Algorithmic Review Boards" within HR departments. These boards should include data engineers, legal compliance officers, HR business partners, and employee representatives. This group is responsible for executing periodic algorithmic impact audits, tracking drift in automated models, and verifying that performance evaluation metrics do not inadvertently penalize employees who require non-traditional flexible working models, such as individuals working compressed four-day workweeks (Wowledge, 2026; Cascio, 2025).

External Macro-Regulatory Compliance Frameworks

At the macro level, HCAI integration is increasingly guided by emergent statutory frameworks. The literature points out that organizations can no longer treat algorithmic ethics as an optional corporate social responsibility initiative. Comprehensive regulatory initiatives, such as the EU AI Act and national initiatives like the Action Plan for Accelerating the Cultivation of Digital Talent (2024–2026), have legally institutionalized accountability requirements for high-risk HR software deployment (Zhang, 2026; Fernandez & Jenkins, 2025). Consequently, contemporary HCAI models must build



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standard legal pathways directly into corporate technology infrastructure to log processing trails, handle automated bias assessments, and manage formal employee data-access requests seamlessly.

Discussion: Limitations and Strategic Future Outlook

While the literature demonstrates the theoretical validity of Human-Centered AI frameworks, significant operational challenges persist. A primary conflict lies in the tension between technical performance metrics and equity constraints; adding rigorous fairness constraints into predictive models can sometimes marginally reduce raw mathematical accuracy (Kavanagh & Johnson, 2024). Additionally, many small-to-medium enterprises (SMEs) face resource constraints, lacking the financial capital and specialized data literacy required to execute continuous algorithmic audits and run cross-functional governance structures (Putri & Wibowo, 2025; Gomez-Mejia, 2024). Furthermore, structural inequalities cannot be completely engineered away purely through algorithmic design. Discrimination is an institutional problem that stems from broader societal inequities, corporate compensation imbalances, and unequal access to digital skill development (Gomez-Mejia, 2024; Lengnick-Hall & Lengnick-Hall, 2025). Therefore, HCAI frameworks should not be viewed as isolated technological quick-fixes. Instead, they must be integrated into comprehensive human-centric corporate initiatives, including proactive digital talent cultivation, objective salary transparency schemas, and inclusive skill development policies designed to prepare the entire workforce for a digitally augmented corporate future (Zhang, 2026; Cascio, 2025).

Conclusion

This systematic literature review underscores that the integration of artificial intelligence within the modern workplace is an inherently non-neutral, socio-technical process. Unregulated, traditional AI deployment risks fortifying algorithmically-mediated inequality regimes that amplify structural prejudices and erode employee autonomy. Human-Centered AI frameworks offer a rigorous, necessary path forward, blending Explainable AI protocols, dedicated human-in-the-loop oversight mechanisms, and cross-functional algorithmic auditing boards. Implementing these frameworks ensures that organizations can successfully capture the immense operational advantages of digital applications while actively dismantling structural demographic barriers. Ultimately, the future of ethical human resource administration depends on the capacity of strategic leaders to treat technological governance not merely as a technical IT checklist, but as a core moral and structural equity imperative.

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Influence of Research Methodology Teaching on Developing Skills in Problem Identification among Colleges of Education Social Studies Students in Niger State, Nigeria

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Abstract

The study examined the “influence of teaching Social Studies research methodology on student’s research skills development in colleges of education in Niger state, Nigeria”. The focus of the study is to examine the influence of teaching Social Studies research methodology on identification of sources of research problems: The study was guided by one research questions, and one hypothesis was tested at 0.05 level of significance. This study adopts descriptive survey design. The study also reviewed related literature, one theory and equally reviewed related empirical studies and comparison were made with the current study. The target population of the study was Social Studies students in Colleges of Education in Niger State, Nigeria. A sample of 248 Social Studies students participated in the study. A researcher developed questionnaire with a reliability index of 0.860, titled “influence of Teaching Social Studies Research Methodology on Students research skills development in colleges of education in Niger state, Nigeria Questionnaire” (ITSSRMSRSDQ) was used for data collection in this study. One research assistants were employed who assisted in the distribution and retrieval of the questionnaire. The data collected for this study was analysed using descriptive and inferential statistics. The descriptive statistics include frequencies and percentage for bio-data, while mean standard deviation was used to answer the research questions, and as well, the hypotheses were tested using one sample t-test. This study found that teaching Social Studies research methodology has influence on development of skills of Sources of research problem identification; the hypotheses were retained. The study concluded that teaching Social Studies research methodology has influence on development of skills of sources of research problem identification; the study recommended that, Colleges of Education should also organize regular workshops and seminars to strengthen students’ abilities to recognize and define educational and social problems.

Keywords: Social Studies, research methodology, problem identification skills.

Introduction

Research problem identification is the foundation of any empirical inquiry. For Social Studies students, the ability to spot gaps in knowledge, frame educational problems, and convert practical issues into researchable questions is essential for producing meaningful final-year projects and for future professional practice as teachers and curriculum developers. Colleges of Education (NCE level) are the principal institutions that prepare prospective teachers; the research methodology course therefore plays a strategic role in equipping Social Studies students with necessary research competencies. However, subjective evidence and supervisors’ reports indicate many NCE Social Studies students continue to submit poorly formulated research problems vague topics, conflation of problems and objectives, or research questions that are neither clear nor researchable. This shortfall undermines the quality of research output, reduces the pedagogic value of the research methods course, and contributes to poor grades and limited research capacity among newly qualified teachers. This study examines the influence of teaching Social Studies research methodology on the development of skills for identifying researchable problems among Social Studies students in Colleges of Education in Niger State, Nigeria. Specifically, it asks: To what extent does instruction in Social Studies research methodology improve students’ ability to



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identify researchable problems? The study tests the hypothesis that, there is no significance difference in the views of students on the influence of teaching Social Studies research methodology on identification of sources of research problem among students in Colleges of Education in Niger State, Nigeria. Research problem identification refers to recognizing, articulating, and refining an issue into a clear, researchable statement or question. Good problem identification requires situating the problem in literature, defining the scope, and ensuring empirical tractability. When students lack these skills, their research proposals often have unfocused aims, poor justifications, and ambiguous variables. Problem-Based Learning (PBL) and experiential learning have been repeatedly recommended to develop higher-order skills such as problem formulation, critical analysis, and research reasoning (Barrows, 1996; Allen & Baughman, 2016). PBL uses real-world scenarios where students must identify and frame the problem, propose directions, and justify their research focus. Scaffolding (structured clinics, stepwise topic workshops) and guided practice (supervised proposal sessions) also show positive effects in similar educational contexts. Several studies in Nigeria and elsewhere have linked active teaching strategies in research methods to improvements in students' research skills (Abingki et al., 2017; Olayiwola, 2019). However, literature focusing specifically on problem identification at the NCE level in Social Studies is sparse most studies aggregate multiple skills (literature review, data analysis, and writing) into one outcome. This gap motivates the focused examination in Niger State. Problem-Based Learning (PBL) theory underpins this study. PBL posits that students learn best when confronted with real problems, which motivates inquiry and develops problem-solving skills. Teaching research methods with PBL elements case studies, real-world problem exploration, group tasks should therefore improve students' ability to identify research problems.

Objectives of the Study

1. Examine the influence of teaching Social Studies research methodology on skills of problem identification among students in Colleges of Education in Niger State, Nigeria.

Research Questions

The study answered the following question:

1. What are the views of Social Studies Students on influence of teaching research methodology on developing problems identification skills among Colleges of Education in Niger State Nigeria?

Research Hypotheses

H₀₁: There is no significance difference in the views of students on the influence of teaching Social Studies research methodology on developing problem identification skills among Colleges of Education in Niger State, Nigeria.

Research Methodology

This study used descriptive survey design. The reason for using it is because it is usually used to determine and describe situation, events, and feelings or opinion of sampled respondents from a large population using questionnaires, check-list, and opinion falls and structured on the views of the population, is an efficient way of gathering data to help in addressing a research questions. Adamu, M. T. (2014). Opines on survey design that, it is a method usually adopted when handling a large population especially on issue of the moment that will involve systematic collection of data from population of study through the use of questionnaire. The population comprised all NCE III Social Studies students in the two Colleges of Education in Niger State (estimated total population $\approx$ 660). Using stratified random sampling a sample of 248 students was selected for the study. (Adjust sample sizes according to your actual population and the sample size calculation in your dissertation. The primary instrument was the Research Problem Identification Skills Questionnaire (RPISQ). RPISQ contains 20 items covering: (a) ability to spot gaps in literature/context, (b) ability to convert a broad topic into a focused problem statement, (c) ability to operationalize the scope and delimitations, and (d) competence in framing research questions/objectives aligned with the problem. Items used a 4-point Likert scale (1 = Strongly Disagree to 4 = Strongly Agree). The instrument was validated by three experts (two Social Studies lecturers and one specialist in measurement and evaluation). Pilot testing (n = 10) produced Cronbach's α = 0.86. Prior to the administration of the instrument, the researcher trained two research assistants on the procedures for effective distribution, guidance, and retrieval of the questionnaires to ensure accuracy and uniformity in the data collection process. After the training, the researcher, together with the two research assistant's one assigned to each institution administered the instrument to NCE III students of Social Studies in both colleges. A total of twenty (5) copies of the questionnaire were administered to the respondents to minimize the risk of mortality (loss of instruments). The researcher and the research assistants personally supervised the



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administration and collection of the completed questionnaires to ensure a high rate of return and data accuracy. All duly completed instruments were retrieved immediately after completion and prepared for statistical analysis. The data collected were analysed using descriptive and inferential statistic. The bio-data of the respondents were analysed using simple percentage and frequency, mean and standard deviation were used to answer all the research questions, while, one sample t-test was used to test all the null hypotheses at 0.05 level of significance, where the p-value is higher than 0.05 level of significance, the null hypotheses was rejected, if otherwise the null hypotheses was retained.

Presentation of Results

1. Research Question One: What are the views of Social Studies Students on influence of teaching research methodology on developing problems identification skills among Colleges of Education in Niger State Nigeria?

To answer this research question, the data collected was subjected to descriptive statistics of mean and standard deviation. Table 1 presents summary of the result.

Table 1: mean and standard deviation on influence of teaching Social Studies research methodology on skills of Sources of research problem identification.

S/N	ITEMS	Mean	SD
1	Teaching of social studies research methodology has increased my confidence in identifying research problems.	3.27	.812
2	I have a better understanding of various sources for identifying research problems due to the Social Studies research methodology course I under took.	2.79	.923
3	I can effectively apply research methodology skills to identify research problems after taking course in Social Studies	3.04	.869
4	The course has improved my ability to evaluate the credibility of different sources for identifying research problems.	3.27	.812
5	I can integrate concepts learned in Social Studies research methodology when identifying research problems during writing my projects	2.79	.923
6	The teaching of Social Studies research methodology has enhanced my critical thinking skills in identifying research problems.	3.04	.869
7	My ability to create research problem has improved because of the social studies research methodology instruction.	2.96	.999
8	The course has increased my engagement with and understanding of the research literature related to Social Studies.	3.06	.889
9	I am better at identifying relevant research topics in Social Studies after taking research in Social Studies.	3.23	.945
10	The teaching of Social Studies research methodology has equipped me with practical skills for identifying research problems in my area of Specialization.	3.23	.880
Cumulative Mean		3.06	.892

Table 1 show that all the statements were above the decision mean of 2.5. This indicates that the respondents accepted all the statements as true. The aggregate mean of the items is 3.06 above the decision mean. This implies that the response to statement of research question one is in the affirmative. Thus, this means that the respondents perceived that teaching Social Studies research methodology has influence on development of skills of Sources of research problem identification among students in Colleges of Education in Niger State, Nigeria?

Testing of Null Hypotheses

H₀₁: There is no significance difference in the views of students on the influence of teaching Social Studies research methodology on developing problem identification skills among Colleges of Education in Niger State, Nigeria.

To test this null hypothesis, one-sample test was used and the result is presented in table 2

Table: 2 Summary of one-sample t-test on the views of students on the influence of teaching Social Studies research methodology on identification of sources of research problem

Respondent	N	Mean	SD	t	Df	P
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Social						
Studies	248	3.07	.411	21.753	247	.000
Students						

Table 2 shows that $t = 21.753$, $df = 247$, $p = .000 < \alpha = 0.00$. This indicates that the probability value (p) is less than the alpha level of significance ($p < 0.00$). Therefore, the null hypothesis is rejected since the p -value is less than the alpha level. It therefore means that there was a significant difference in the views of students on the influence of teaching Social Studies research methodology on the identification of sources of research problems among students in Colleges of Education in Niger State, Nigeria.

Discussion of Findings

This chapter discusses the findings of the study on the influence of teaching Social Studies research methodology on the development of research skills among students in Colleges of Education in Niger State, Nigeria. The discussion is organised around each of the research skill areas investigated. Finding number one indicates that the study found no difference on the influence of teaching Social Studies research methodology on research problem identification among students in Colleges of Education in Niger State, Nigeria. Evidently, table 1 which depicts statement in response to research question one, adjudged that teaching of Social Studies research methodology has increased student's: confidence in identifying research problems; better understanding of various sources for identifying research problems; effectively identify research problems; ability to evaluate the credibility of different sources for identifying research problems; identifying research problems during writing my projects; enhanced my critical thinking skills in identifying research problems; ability to create research problem; understanding of the research literature related to Social Studies; ability in identifying relevant research topics in Social Studies; and practical skills for identifying research problems. The corresponding hypothesis established a statistically significant difference between the views students in Federal College of Education and State college of education on the influence of teaching Social Studies research methodology on identification of sources of research problem among students in Colleges of Education in Niger State, Nigeria ($t = 21.753$, $df = 247$, $p = .000 < \alpha = 0.00$). This finding may be attributed to the structured, inquiry-based instructional approach used in teaching research methodology, where students are systematically guided through identifying societal challenges and knowledge gaps. Practical exposure to real-life problems likely enhanced their ability to recognize and formulate research problems. This finding aligns with previous research such as Ojini (2024). The implication of this finding is that Social Studies instructors should continue to adopt inquiry-based and participatory teaching methods when handling research methodology courses to further enhance students' skills in identifying relevant and feasible research problems.

Conclusion

The focus of this study is to investigate the “influence of Teaching Social Studies Research Methodology on Students Research Skills Development in Colleges of Education in Niger State, Nigeria”. The findings of this study highlight the critical role of teaching Social Studies research methodology in influencing student's research skills development in Colleges of Education. Given the findings of this study, the following conclusions are made: teaching Social Studies research methodology has impact on development of skills of sources of research problem identification; teaching Social Studies research methodology has influenced the developing skills on variable identification; influence their developing related literature review skills of students; and teaching Social Studies research methodology, to a greater extent, influences students' skills of data analysis among students and teaching Social Studies research methodology influence students' acquiring research reports development skills among students in Colleges of Education in Niger state, Nigeria.

Recommendations

Based on the findings of this study, the following recommendations are proposed to enhance research skills development among Social Studies students in Colleges of Education in Niger state, Nigeria.

1. Lecturers should keep emphasizing on practical exercises that involve spotting real-life issues as research topics. Colleges of Education should also organize regular workshops and seminars to strengthen students' abilities to recognize and define educational and social problems.

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Qualitative Study on Digital Transformation in Educational ... Yusuf, A., Et. al., (2026)

Qualitative Study on Digital Transformation in Educational Administration: A Catalyst for Institutional Effectiveness in Nigerian Colleges of Education

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Abstract

Nigerian Colleges of Education continue to administer core institutional functions admissions, records management, staff deployment, resource allocation, and quality assurance through largely manual and fragmented systems, even as national policy instruments increasingly assume a digitally enabled administrative environment. This position paper argues that the digital transformation of educational administration is not a peripheral modernization project but a necessary catalyst for institutional effectiveness in Nigerian Colleges of Education, and that its absence constitutes a structural constraint on the sector's capacity to deliver quality teacher education at scale. Drawing on Technology-Organization-Environment (TOE) theory, Diffusion of Innovation theory, and institutional effectiveness frameworks, the paper critically examines evidence from Nigerian and comparable Sub-Saharan African contexts on administrative digitalization, evaluating its contribution to decision-making quality, accountability, resource efficiency, and stakeholder engagement. The discussion identifies persistent barriers inadequate ICT infrastructure, inconsistent funding, limited digital competence among administrative staff, weak cybersecurity and data governance, and fragmented policy implementation that have constrained transformation to isolated pilot initiatives rather than systemic change. The paper contends that institutional effectiveness in Colleges of Education cannot be sustainably achieved without deliberate investment in digital governance architecture, capacity development, and policy coherence between national ICT frameworks and college-level implementation. It concludes with actionable recommendations for college administrators, the National Commission for Colleges of Education, and policymakers, emphasizing phased infrastructure investment, mandatory digital competency development, harmonized data governance standards, and institutionalized monitoring mechanisms as preconditions for translating digital transformation into measurable gains in institutional effectiveness and, by extension, teacher education quality.

Keywords: digital transformation, educational administration, institutional effectiveness, teacher education

Introduction

The administrative infrastructure of Nigerian Colleges of Education has historically relied on paper-based and manually mediated processes for functions as consequential as student admissions, examination records, staff payroll, and institutional reporting (Adeyemi, 2019; Okonkwo & Eze, 2021). This reliance persists despite two decades of national policy rhetoric committing the education sector to information and communication technology (ICT) integration, beginning with the National Policy on Education's ICT provisions and reinforced by subsequent instruments such as the National Commission for Colleges of Education's (NCCE) Minimum Standards and the National Digital Economy Policy and Strategy (Federal Ministry of Communications and Digital Economy, 2020). The gap between policy ambition and administrative practice is particularly acute in Colleges of Education, a sub-sector that trains the majority of Nigeria's basic and post-basic education teaching workforce and is therefore structurally central to the country's human capital pipeline (National Commission for Colleges of Education [NCCE], 2021). Educational administration, in this context, is understood broadly as the set of institutional processes planning, decision-making, resource management, personnel administration, communication, and quality assurance—through which a College of Education organizes itself to achieve its educational mandate (Peretomode, 2018). Digital transformation of this administrative core refers not merely to the adoption of discrete software tools but to a systemic reconfiguration of institutional processes, governance structures, and organizational culture around digital technologies (Vial, 2019). This distinction matters: much of what has been described as "digitalization" in Nigerian tertiary institutions amounts to the digitization of individual artifacts scanned files, standalone spreadsheets



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without the integrated, process-level transformation that digital transformation properly denotes (Adenuga et al., 2022). The stakes of this administrative gap are heightened by the scale and complexity of the Colleges of Education sub-sector. Nigeria operates over 150 Colleges of Education (federal, state, and private), collectively enrolling hundreds of thousands of students under administrative systems that vary widely in capacity and sophistication (NCCE, 2021). Institutional effectiveness in this sub-sector defined as the degree to which an institution achieves its stated mission through efficient use of resources, sound governance, and demonstrable outcomes (Cameron, 2020) depends heavily on administrative functions that are increasingly difficult to execute reliably at scale without digital systems: verifying credentials, tracking student progression, managing accreditation documentation, and generating the data policymakers require for evidence-based planning. The COVID-19 pandemic exposed this vulnerability starkly. Colleges with limited digital administrative infrastructure struggled not only to sustain instruction but to perform basic continuity functions processing results, maintaining communication with students and staff, and reporting to regulatory bodies (Iwu et al., 2022; Ogunode & Ajape, 2021). This disruption has since catalyzed renewed institutional and policy interest in digital transformation, but interest alone has not translated into systemic change, and the risk is that post-pandemic momentum dissipates into another cycle of underfunded pilot projects. The significance of this problem extends beyond individual institutional efficiency to the broader national teacher supply pipeline, since Colleges of Education are the primary mechanism through which Nigeria's persistent qualified-teacher shortfall is to be closed (NCCE, 2021). Administrative inefficiency that slows admissions processing, delays certification, or compromises records integrity therefore has downstream consequences for teacher supply nationally compounded by a fragmented regulatory architecture that leaves individual colleges to pursue digitalization in isolation rather than as part of a coordinated agenda.

Purpose of the Study

This paper advances a position, grounded in theory and empirical evidence, that digital transformation of educational administration should be treated by Nigerian Colleges of Education and their regulatory bodies as a strategic catalyst for institutional effectiveness rather than a discretionary or purely technical undertaking. It examines the theoretical basis for this claim, critically reviews the empirical evidence on digital administrative transformation in Nigerian and comparable contexts, and derives policy and practical recommendations for accelerating a coherent, sustainable transformation agenda. The paper also argues that the digital transformation of educational administration encompassing governance, records management, decision-support systems, and stakeholder communication is a necessary, though not sufficient, condition for institutional effectiveness in Nigerian Colleges of Education, and that realizing this potential requires deliberate, coordinated investment in infrastructure, human capacity, and digital governance frameworks rather than isolated technology procurement.

Statement of the Problem

Despite two decades of ICT policy pronouncements, the administrative core of most Nigerian Colleges of Education remains substantially undigitalized or only partially digitalized, and where digital tools have been adopted, implementation is frequently fragmented, under-resourced, and disconnected from institutional strategy. The consequence is an administrative environment characterized by data fragmentation, delayed and error-prone reporting, weak evidence for decision-making and administrative inefficiencies that constrain the sub-sector's capacity to deliver on its teacher education mandate. The literature has documented individual barriers to ICT adoption in Nigerian higher education administration extensively, but there remains insufficient scholarly argument connecting digital transformation directly and explicitly to institutional effectiveness as a strategic imperative for Colleges of Education specifically, as distinct from universities or polytechnics, whose governance and funding contexts differ materially.

Conceptual Framework

Digital transformation

Vial (2019) defined digital transformation as a process whereby digital technologies trigger significant changes to organizational properties through the reconfiguration of processes, structures, and value-creating pathways. Applied to educational administration, this means integrating digital technologies into governance, records management, communication, and quality assurance in ways that alter how these functions are performed rather than simply automating their existing paper-based logic.



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Educational administration

Peretomode (2018), encompasses the processes of planning, organizing, directing, coordinating, and controlling institutional resources toward the achievement of educational objectives here, admissions and records administration, staff establishment, budget and procurement, facilities management, and quality assurance.

Institutional effectiveness

Drawing on Cameron (2020) and adapted for Nigerian tertiary contexts by Okebukola (2021), as the extent to which an institution efficiently converts available resources into the achievement of its educational mission, evidenced through accreditation outcomes, graduate quality, resource utilization, stakeholder satisfaction, and organizational responsiveness.

Theoretical Framework

Technology Organization Environment (TOE) Framework

Developed by Tornatzky and Fleischer (1990), the TOE framework posits that an organization's adoption and effective use of technological innovation is shaped by technological context (available technologies and infrastructure), organizational context (structure, resources, culture), and environmental context (regulatory and stakeholder pressures). This suits Colleges of Education well: institutions face similar environmental pressures (NCCE accreditation, national ICT policy) but differ substantially in organizational readiness and infrastructure, producing divergent transformation trajectories across otherwise comparable institutions.

Diffusion of Innovation (DOI) Theory

Rogers's (2003) DOI theory explains how innovations spread within a social system, identifying adopter categories and the innovation attributes relative advantage, compatibility, complexity, trialability, observability that shape adoption decisions. Applied here, DOI theory explains persistent resistance among administrative staff: digital systems are often perceived as high in complexity and low in compatibility with existing bureaucratic routines, slowing diffusion even where relative advantage is, in principle, substantial.

Institutional Effectiveness Theory

Institutional effectiveness scholarship (Cameron, 2020; Astin & Antonio, 2012) treats effectiveness as multidimensional spanning goal attainment, process efficiency, resource acquisition, and stakeholder satisfaction allowing this paper to argue that digital transformation contributes to effectiveness through several distinct pathways simultaneously rather than a single mechanism.

Digital Governance

A fourth, organizing construct digital governance—refers to the policies, standards, and decision rights that determine how an institution manages digital systems and data over their lifecycle (Janssen & van der Voort, 2020), distinguishing transformation as a technical event from transformation as a sustained institutional capability. Much of the disuse pattern documented in the Nigerian literature (Adeyemi, 2019) reflects a governance failure as much as an adoption failure.

Integrated Theoretical Position

Taken together, these frameworks position digital transformation as an organizational-level intervention mediated by organizational readiness (TOE) and adoption dynamics (DOI), sustained through digital governance capacity, and ultimately measured against multidimensional institutional effectiveness criteria. This layered model clarifies why isolated technology procurement the dominant Nigerian pattern so often fails: it addresses only the technological dimension, leaving organizational readiness, diffusion, and governance sustainability unaddressed. The critical discussion below uses this model to distinguish cases that addressed all four dimensions from the more numerous cases that addressed only the first.

Critical Discussion

A growing body of evidence associates digital administrative systems with measurable gains in institutional efficiency and decision quality in higher education contexts. Adenuga et al. (2022), in a study spanning selected Nigerian tertiary institutions, found that institutions with integrated student information systems demonstrated significantly faster results-processing turnaround and fewer record discrepancies than institutions relying on manual or semi-digital systems. Similarly, Okonkwo and Eze (2021) documented that Colleges of Education that had adopted electronic document management for accreditation purposes experienced smoother NCCE resource verification visits, attributing this to the ease of retrieving and cross-referencing institutional records on demand.



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Beyond efficiency, digital administrative systems strengthen the evidentiary basis for institutional decision-making. Ogunode and Ajape (2021) argue that data-driven decision-making, long theorized in the general education administration literature (Mandinach & Gummer, 2016), remains largely aspirational in Nigerian Colleges of Education precisely because administrative data exist in disconnected silos—paper files, unlinked spreadsheets, departmental registers that cannot be aggregated into institution-level dashboards. Where colleges have implemented integrated management information systems, administrators report an improved capacity to identify enrollment trends, staff workload imbalances, and resource bottlenecks before they become acute (Iwu et al., 2022). Digital transformation also plausibly strengthens stakeholder engagement and institutional legitimacy. Communication technologies institutional portals, SMS and email notification systems, mobile applications have been shown in comparable Sub-Saharan African contexts to improve student and parent engagement with administrative processes such as fee payment, registration, and results release (Kigotho & Wanjala, 2020, discussing Kenyan tertiary institutions), a pattern plausibly transferable to the Nigerian context given similar infrastructural and demographic conditions.

Function-by-Function Analysis

A finer-grained look across specific administrative functions clarifies both the potential and the unevenness of digital transformation's impact. In admissions and academic records, Adenuga et al. (2022) found that colleges extending digitalization beyond the centralized JAMB screening interface into internally integrated student records systems reduced duplicate registration errors and shortened transcript turnaround time; where digitalization stopped at initial admission and reverted to manual processing thereafter the more common pattern these gains did not materialize, consistent with the TOE prediction that technological context alone, without organizational follow-through, is insufficient. In financial and resource administration, Ogunode and Ajape (2021) note that electronic payment and budget-tracking systems improved colleges' capacity to reconcile internally generated revenue against expenditure, but that systems introduced without corresponding staff training in financial data interpretation produced records that were technically accurate yet functionally underused for planning administrators possessed the data but lacked the analytic habit to apply it, echoing Mandinach and Gummer's (2016) broader argument that data availability does not automatically produce data-informed practice. Furthermore, quality assurance and accreditation administration shows the clearest catalytic potential, precisely because it is externally incentivized through the NCCE accreditation cycle: colleges maintaining electronic document repositories for accreditation-relevant records experienced measurably smoother resource verification visits and reduced accreditation preparation burden (Okonkwo & Eze, 2021), supporting this paper's later recommendation to formally incorporate digital administrative capacity into accreditation criteria. Furthermore, Communication and stakeholder engagement tools SMS notification, institutional websites, mobile applications have seen more rapid, organic adoption than back-office systems, plausibly reflecting higher relative advantage and lower complexity from the end-user perspective (Rogers, 2003); Kigotho and Wanjala (2020) and, in the Nigerian pandemic context, Iwu et al. (2022) both corroborate measurable engagement gains from such tools. Considered together, this evidence supports a more precise version of the paper's position: digital transformation's catalytic effect concentrates where external accountability pressure, end-user relative advantage, and follow-through investment coincide, and is largely absent where any of these three conditions is missing.

Critical Limitations and Contrary Evidence

The position advanced here is not that digital transformation automatically produces institutional effectiveness; the literature offers substantial caution against such technological determinism. Adeyemi (2019) documents Colleges of Education that acquired hardware and software under donor or government ICT initiatives which subsequently fell into disuse within two to three years, attributing this to the absence of accompanying investment in maintenance, staff training, and process redesign consistent with what Toyama (2015) terms the "amplification" effect, whereby digital tools amplify existing institutional capacity, or dysfunction, rather than substituting for it. A further limitation concerns equity: Okebukola (2021) cautions that digitalization concentrated in urban federal colleges risks widening the effectiveness gap with state and rural colleges lacking comparable infrastructure, potentially converting a technology meant to strengthen the sub-sector into a mechanism of institutional stratification. Cybersecurity and data governance represent a further, frequently underexamined limitation. As colleges digitize sensitive records, they assume risks breaches, unauthorized alteration, downtime for which most currently lack formal governance policies or incident response protocols (Adenuga et al., 2022), and the absence of a tertiary-specific national data governance framework, despite the Nigeria Data Protection Act (2023), leaves individual colleges to develop ad hoc and inconsistent practices. A brief comparative note reinforces



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this reading. South Africa's TVET college sub-sector, despite comparatively better national ICT infrastructure, shows similarly uneven translation of centrally mandated systems into institutional-level use, tied to campus leadership capacity (Adenuga et al., 2022). Kenya's more centrally coordinated rollout of placement and student information systems, by contrast, has produced more consistent digitalization outcomes across institutions (Kigotho & Wanjala, 2020) a difference plausibly attributable to stronger central coordination than Nigeria's more fragmented regulatory landscape affords, though cross-national differences in funding and scale limit direct transferability.

Comparative and Synthesized Assessment

Weighing this evidence, a SWOT-informed synthesis is instructive. The strengths of digital administrative transformation efficiency, improved decision quality, enhanced stakeholder engagement are well supported empirically, though largely from small-scale or institution-specific studies rather than sector-wide longitudinal research, a gap this paper flags as a priority for future inquiry. The weaknesses center on implementation: technology adoption without organizational readiness produces disuse or superficial compliance rather than transformation. Opportunities exist in leveraging existing national digital economy policy momentum, mobile penetration rates, and post-pandemic institutional openness to change. Threats include funding volatility, the inter-institutional digital divide, weak cybersecurity governance, and the risk that digital transformation becomes another unfunded policy mandate layered onto already resource-constrained institutions. This synthesis supports a qualified but firm version of the paper's thesis: digital transformation is a genuine catalyst for institutional effectiveness, but only when technological investment is matched by organizational readiness leadership commitment, staff capacity, and process redesign—and situated within a coherent governance and funding framework. Technology procurement decoupled from these conditions does not merely fail to catalyze effectiveness; it risks entrenching existing inefficiencies under a veneer of modernization.

Policy and Practical Implications

1. For college administrators, the evidence implies that digital transformation initiatives should be conceived as institutional change management projects, not IT procurement exercises. Leadership commitment, staff involvement in system design, and phased implementation with adequate training lead times are preconditions for sustained adoption, consistent with DOI theory's emphasis on compatibility and trialability. Provosts and Registrars should resist treating a system's go-live date as the endpoint of a transformation project; sustained gains depend on a subsequent period of embedded use and workflow adjustment that is frequently under-resourced once procurement targets are met.
2. For the National Commission for Colleges of Education, the implications concern standard-setting and accreditation practice. Incorporating digital administrative capacity demonstrable use of integrated records and reporting systems, not merely hardware presence into minimum standards and accreditation criteria would create a regulatory incentive structure aligned with the transformation agenda, while requiring NCCE to build corresponding capacity to assess such criteria consistently across visits.
3. For government agencies and policymakers, the implications center on funding architecture and policy coherence. Current ICT interventions are frequently project-based and donor-dependent, producing the disuse pattern documented by Adeyemi (2019). A shift toward recurrent budget lines for infrastructure maintenance and staff development, alongside a coordinating mechanism capable of setting interoperable data standards across federal and state colleges, would address the sustainability and fragmentation gaps identified throughout the discussion.
4. For teacher educators and administrative staff, the implications are professional-developmental: digital competence should be a core, mandatory, periodically refreshed administrative competency rather than an informally acquired skill, embedded within continuing professional development structures given that many administrative staff are drawn from the academic ranks.
5. For other stakeholders, including students, parents, and quality assurance bodies, digital transformation implies both improved service delivery and a corresponding expectation of institutional transparency and accountability, which colleges must meet through appropriate data governance safeguards, lest visibility without responsiveness undermine stakeholder confidence in the broader agenda.



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Recommendations

1. Institutionalize phased ICT infrastructure investment; Colleges of Education and their funding authorities should adopt multi-year infrastructure investment plans covering connectivity, hardware, and system maintenance financed through recurrent rather than solely capital or donor budget lines, prioritizing the functions shown in Section 3.2 to carry the clearest catalytic potential (academic records, quality assurance documentation) before extending to lower-priority functions.
2. Mandate structured digital competency development for administrative staff: NCCE and college management should establish mandatory, periodically refreshed digital literacy and systems-use training, integrated into staff performance appraisal and delivered in the context of actual institutional workflows rather than generic computer literacy instruction, with peer-support structures pairing early adopters with colleagues.
3. Incorporate digital administrative capacity into NCCE minimum standards and accreditation criteria: This would create regulatory incentives for genuine transformation rather than superficial technology acquisition, backed by standardized rubrics assessing actual system use and data quality rather than hardware presence alone.
4. Develop a sector-specific data governance and cybersecurity framework: The Federal Ministry of Education and NCCE, working with the Nigeria Data Protection Commission, should operationalize the Nigeria Data Protection Act (2023) for student and staff records, including minimum requirements for backup, access control, incident response, and a designated data protection focal officer at each college.
5. Prioritize equity in transformation rollout: Funding and technical support programs should include explicit provisions—weighted funding formulas, phased rollout targets, or shared regional service arrangements among clusters of colleges to prevent state, rural, and less-resourced institutions from being structurally excluded from the transformation agenda.
6. Establish institutional monitoring and evaluation mechanisms: Colleges should track defined indicators records-processing turnaround, system uptime, staff usage rates, accreditation preparation time with NCCE defining a common minimum indicator set to enable cross-institutional comparison and build the sector-wide evidence base current research largely lacks.

Conclusion

Digital transformation of educational administration is a critical catalyst for improving institutional effectiveness in Nigerian Colleges of Education, provided it is implemented within a supportive organizational and policy environment. Evidence suggests that technology enhances administrative efficiency, decision-making, and stakeholder engagement only when accompanied by adequate infrastructure, skilled personnel, sustainable funding, effective governance, and institutional readiness. Consequently, digital transformation should be pursued as a comprehensive institutional reform rather than a standalone technological initiative. The paper also highlights the need for longitudinal, sector-wide studies to establish stronger evidence on the long-term effects of digital transformation on institutional effectiveness. Ultimately, the challenge for Nigerian Colleges of Education is not whether to embrace digital transformation, but how to implement it sustainably, strategically, and equitably to strengthen the future of teacher education.

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Influence of Digital Technology Integration on Performance, Interest and Engagement in Biology among Secondary School Students in Edu, Kwara State, Nigeria

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Abstract

This study investigated the influence of digital technology integration on performance, interest and Engagement in Biology among secondary school students in Edu Local Government Area of Kwara State, Nigeria. A descriptive survey research design was adopted, and a sample of 150 senior secondary school students was selected from public secondary schools in the study area using a convenience sampling technique. Data were collected through a structured questionnaire validated by experts in Science Education and Educational Measurement. Descriptive statistics, including frequencies and percentages, were used to answer the research questions, while chi-square (χ^2) statistics were employed to test the hypotheses at the 0.05 level of significance. Findings revealed that digital technology integration positively influenced students' learning outcomes in Biology. A majority of the respondents reported improved understanding of complex biological concepts, increased classroom attention, enhanced motivation, and greater interest in Biology when digital tools such as videos, animations, simulations, and online resources were utilized. The results further indicated that digital technology integration had a significant effect on students' academic performance ($\chi^2=12.90$, $p < 0.05$), interest in Biology ($\chi^2=15.84$, $p < 0.05$), and engagement in Biology learning ($\chi^2=18.72$, $p < 0.05$). Despite these positive outcomes, inadequate digital infrastructure and limited access to technological resources were identified as major challenges to effective implementation. The study concluded that digital technology integration significantly enhances Biology teaching and learning by improving students' academic performance, interest, and engagement. It recommended increased investment in digital infrastructure, teacher training, and the provision of technology-supported learning resources to improve science education outcomes in secondary schools.

Keywords: Digital Technology Integration, Biology, Academic Performance, Interest & Engagement.

Introduction

The twenty-first century has witnessed unprecedented advances in digital technologies, resulting in profound transformations across numerous sectors, particularly education. The integration of digital technologies into teaching and learning has become a global priority because of its potential to enhance instructional effectiveness, increase learner engagement, and improve educational outcomes. Digital technology integration in education refers to the deliberate and pedagogically informed use of technological tools and resources—such as computers, multimedia applications, internet-based resources, virtual laboratories, educational software, mobile devices, simulations, and learning management systems—to support and enrich teaching and learning processes. As educational systems continue to evolve in response to the demands of a digitally driven world, technology is increasingly recognized as an indispensable component of contemporary education. Modern educational systems acknowledge the critical role of technology in preparing learners to thrive in a knowledge-based and digitally interconnected society. According to UNESCO (2023), digital technologies represent one of the most transformative innovations in modern education, offering opportunities for personalized learning, collaborative knowledge construction, and expanded access to educational resources. However, the effectiveness of technology integration depends largely on the quality of implementation, teachers' technological competencies, the availability of adequate infrastructure, and learners' digital readiness (GEM Report, 2023). The growing recognition of technology's educational value has contributed to the emergence of technology-enhanced learning environments, which have transformed traditional approaches to teaching and learning. This transformation has encouraged a shift from teacher-centred instructional practices toward more interactive and learner-centred pedagogies that promote collaboration, critical thinking, creativity, and self-directed learning. Empirical evidence from diverse educational contexts indicates that, when effectively implemented, digital technologies significantly enrich learning experiences by providing students with immediate access to information, interactive content, and personalized learning opportunities. Consequently, digital



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technology has become a central component of educational reform initiatives aimed at improving the quality, accessibility, and effectiveness of teaching and learning worldwide (Usman, Oyeronke, & Hussaini, 2024). Beyond the provision of technological devices in schools, effective digital technology integration requires the systematic incorporation of technology into curriculum delivery, classroom instruction, assessment practices, and learning activities. Recent studies by Maričić and Lavicza (2024) and Umar, Soladoye, Tunde, Frankling, Adekunle, Peter, and Gafar (2024) revealed that technology-enhanced learning environments promote active learning by enabling students to interact with content through multimedia presentations, simulations, animations, virtual experiments, and collaborative digital platforms. These studies further reported that emerging technologies facilitate deeper cognitive engagement and foster the development of creativity, critical thinking, and problem-solving skills. In science education, particularly, digital technologies provide visual and interactive representations of abstract concepts that are often difficult to explain using conventional instructional methods. As a result, educators across the globe are increasingly adopting technology-supported pedagogies to enhance students' understanding and participation in science-related subjects.

Within the domain of science education, Biology occupies a particularly important position because of its relevance to numerous professional and societal needs. At the secondary school level, Biology provides foundational knowledge required for careers in medicine, nursing, pharmacy, agriculture, environmental science, biotechnology, and other health-related professions. Furthermore, it contributes significantly to scientific literacy by enabling learners to understand the structure and functions of living organisms, ecological relationships, genetic inheritance, environmental sustainability, and public health issues. Despite its importance, students' academic performance in Biology remains a major concern in many developing countries, including Nigeria. Several studies have attributed students' poor achievement in Biology to factors such as inadequate instructional materials, ineffective teaching methods, insufficient laboratory facilities, low student motivation, and limited opportunities for active participation during classroom instruction (Aina & Sofowora, 2023; Oyelekan et al., 2022). Given these persistent challenges, researchers and educators have increasingly explored innovative instructional approaches capable of improving students' learning outcomes in Biology. Academic performance refers to the extent to which students successfully achieve learning objectives as measured through tests, examinations, assignments, classroom participation, and other assessment indicators. Educational researchers argue that technology-supported learning environments can improve academic performance by enhancing students' comprehension, retention, and application of knowledge. Through multimedia resources, simulations, animations, and interactive learning activities, students are exposed to richer learning experiences that facilitate deeper cognitive processing. In Biology education, where many concepts are abstract and difficult to visualize through conventional instructional methods, digital technologies provide opportunities for students to observe biological processes virtually and engage more meaningfully with scientific content. A recent quasi-experimental study conducted by Falebita and Asimolowo (2025; 2026) found that students exposed to interactive multimedia Biology instruction demonstrated significantly higher academic achievement than those taught using conventional instructional approaches. Similarly, Adeleye (2023) reported that multimedia-assisted instruction significantly improved Biology students' academic performance compared with traditional lecture methods. These findings suggest that effective digital technology integration can substantially enhance students' academic outcomes. While academic performance remains a crucial pointer of educational success, it is equally important to consider students' interest in learning, as interest often serves as a catalyst for sustained engagement and achievement. Interest refers to a learner's psychological inclination, enthusiasm, and willingness to engage in learning activities. Educational researchers have consistently emphasized that students who demonstrate higher levels of interest in a subject are more likely to participate actively in classroom activities, devote time to independent study, and achieve better academic outcomes. Digital technologies can stimulate students' interest by making lessons more interactive, engaging, and relevant to their everyday experiences. Features such as animations, educational games, virtual reality, simulations, and multimedia presentations can capture students' attention and increase their enthusiasm for learning scientific concepts. Recent research on educational technology suggests that technology-supported instruction enhances learners' motivation and fosters positive attitudes toward learning by creating dynamic and student-centred learning environments (Himendra, 2024). Further related to students' interest is the concept of student engagement, which represents another critical determinant of successful learning outcomes. Student engagement encompasses students' behavioural, emotional, and cognitive involvement in learning activities. Engaged students actively participate in classroom discussions, complete learning tasks, collaborate with peers,



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and demonstrate persistence in overcoming academic challenges. Educational psychologists have consistently argued that students who exhibit high levels of engagement are more likely to demonstrate stronger intrinsic motivation, participate actively in learning activities, and achieve superior academic outcomes. Digital technologies possess considerable potential to enhance engagement by creating dynamic learning environments characterized by interactivity, collaboration, immediate feedback, and learner autonomy (Mirjana & Zsolt, 2024). Nevertheless, the extent to which these technologies influence students' engagement and academic performance may depend on factors such as accessibility, digital competence, instructional quality, and institutional support. Understanding the relationship between digital technology integration, students' academic performance, interest, and engagement is therefore essential for informing educational policies and instructional practices aimed at improving Biology learning outcomes in contemporary secondary schools.

Statement of the Problem

Despite the documented benefits of digital technology integration, many secondary schools in developing countries continue to face significant implementation challenges. In Nigeria, the integration of digital technologies into classroom instruction remains constrained by inadequate ICT infrastructure, unreliable electricity supply, limited internet connectivity, insufficient funding, and inadequate teacher training (UNESCO, 2023). Although educational policies advocate the incorporation of technology into teaching and learning processes, implementation remains uneven across urban and rural schools. Recent studies indicate that while students increasingly utilize digital technologies for learning purposes, access to quality digital learning resources and effective technology-supported instruction remains limited in many schools. These challenges may hinder the realization of the full educational benefits associated with digital technology integration. Within Kwara State, particularly in Edu Local Government Area, empirical evidence regarding the impact of digital technology integration on students' academic performance, interest, and engagement in Biology remains limited. While previous studies have examined technology integration in broader educational contexts, few have specifically investigated its influence on Biology learning outcomes among secondary school students in Edu LGA. Given the increasing emphasis on digital transformation in education and the strategic importance of Biology in science education, there is a need to examine how digital technology integration influences students' academic performance, interest, and engagement in Biology. It is against this background that this study investigates the impact of digital technology integration on Biology teaching and learning among secondary school students in Edu Local Government Area, Kwara State, Nigeria.

Research Questions

1. What is the impact of digital technology integration on students' academic performance in Biology?
2. What is the influence of digital technology integration on students' interest in learning Biology?
3. What is the influence of digital technology integration on students' engagement in Biology learning?

Research Hypotheses

H₀₁: Digital technology integration has no significant impact on students' academic performance in Biology.

H₀₂: Digital technology integration has no significant influence on students' interest in learning Biology.

H₀₃: Digital technology integration has no significant influence on students' engagement in Biology learning.

Literature Review

Concept of Digital Technology in Education

Digital technology refers to electronic tools, systems, devices, and resources that generate, process, store, and transmit information. In educational contexts, digital technologies include computers, tablets, smartphones, internet resources, learning management systems, simulations, virtual laboratories, and multimedia applications. According to UNESCO (2023), digital technologies facilitate equitable access to education and enhance teaching effectiveness through personalized and interactive learning experiences. Similarly, the European Commission's DigCompEdu Framework emphasizes that digital competence has become an essential component of effective teaching and learning in contemporary educational systems.

Digital Technology and Biology Education

Biology education benefits significantly from digital technologies because many biological concepts involve microscopic structures, dynamic processes, and complex interactions that are difficult to visualize through conventional methods. Recent studies indicate that digital simulations and virtual laboratories enhance students' conceptual understanding and



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scientific reasoning. Bond et al. (2024) found that technology-supported science instruction significantly improves learner engagement and achievement. Likewise, Hennessy et al. (2023) reported that digital pedagogies increase student participation and collaborative learning in science classrooms. Virtual learning environments enable students to observe biological phenomena, conduct simulated experiments, and access multimedia resources that support deeper understanding. Research by Redecker and Punie (2023) further demonstrates that technology-enhanced science instruction promotes inquiry-based learning and critical thinking.

Empirical Review

Several studies have reported positive outcomes associated with digital technology integration in science education. Aina (2023) found that secondary school students exposed to digital instructional materials performed significantly better in Biology than those taught using traditional methods. Similarly, Adeyemi and Olatunji (2024) reported that multimedia-supported instruction improved retention and motivation among Biology students in Nigerian secondary schools. Internationally, OECD (2023) observed that effective educational technology integration contributes to improved learning outcomes when supported by adequate teacher training and infrastructure. However, studies also reveal persistent barriers such as inadequate funding, insufficient digital competence among teachers, unreliable electricity supply, and limited internet connectivity.

Challenges of Digital Technology Integration

Despite its benefits, several factors hinder successful technology integration in Nigerian schools:

1. Inadequate funding for ICT infrastructure.
2. Limited access to computers and internet facilities.
3. Poor electricity supply.
4. Insufficient teacher training and digital literacy.
5. Resistance to pedagogical change.
6. Weak institutional support and policy implementation.

These constraints continue to limit the realization of the full educational benefits of digital technologies.

Theoretical Framework

Technology Acceptance Model (TAM)

This study is anchored on the **Technology Acceptance Model (TAM)** developed by Davis (1989) and subsequently extended by Venkatesh and Davis (2000). The model posits that individuals' adoption of technology is influenced primarily by:

1. Perceived Usefulness (PU): The degree to which users believe technology enhances performance.
2. Perceived Ease of Use (PEOU): The degree to which technology is perceived as easy to use.

In the context of Biology education, students and teachers are more likely to adopt digital technologies when they perceive such technologies as useful for improving learning outcomes and easy to operate. The positive responses reported by students regarding improved understanding, engagement, and performance support the assumptions of TAM.

Constructivist Learning Theory

The study is also supported by Constructivist Learning Theory, particularly the works of Piaget and Vygotsky. Constructivism argues that learners actively construct knowledge through interaction with their environment. Digital technologies facilitate collaborative learning, inquiry-based exploration, and experiential learning, thereby supporting knowledge construction in Biology education. The combination of TAM and Constructivism provides a robust theoretical foundation for explaining both technology adoption and its educational outcomes.

Research Methodology

This study adopted a descriptive survey research design to investigate the impact of digital technology integration on Biology teaching and learning among secondary school students in Edu Local Government Area, Kwara State. The population of the study comprised senior secondary school students in selected public secondary schools within the study area. A sample size of 150 students was selected using a convenience sampling technique to ensure that respondents who had been exposed to digital technology in Biology instruction were adequately represented. Data for the study were collected through a structured questionnaire designed by the researcher based on the objectives of the study and the research questions. The questionnaire consisted of two sections. Section A elicited demographic information such as gender, age,



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class level, and religion, while Section B contained items measuring students' perceptions of the impact of digital technology on academic performance, interest, and engagement in Biology learning. The instrument was structured on a four-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). Prior to administration, the questionnaire was subjected to face and content validation by experts in Science Education and Educational Measurement to ensure its appropriateness and relevance to the study objectives. Data were collected directly from the respondents with the assistance of school authorities and class teachers. The completed questionnaires were coded and analyzed using descriptive and inferential statistics. Frequency counts and percentages were used to answer the research questions, while the chi-square (χ^2) statistical technique was employed to test the hypotheses at a 0.05 level of significance. The results were presented in tables and interpreted in line with the objectives of the study.

Presentation of Results

Research Question One: What is the impact of digital technology integration on students' academic performance in Biology in secondary schools in Edu Local Government Area, Kwara State?

Table 1: Students' Responses on the Impact of Digital Technology Integration on Academic Performance in Biology (N = 150)

S/N	Item	SA (%)	A (%)	D (%)	SD (%)
1	I learn Biology better when digital tools (videos, animations, simulations) are used	40.0	30.7	22.7	6.7
2	Digital technology makes Biology lessons more interesting	38.0	41.3	20.0	0.7
3	I understand complex Biology concepts better through visual aids	46.7	35.3	13.3	4.7
4	I prefer using apps or online resources to study Biology	40.7	32.0	26.7	0.7
5	Digital tools used in Biology increase my interest in science subjects	38.7	33.3	26.0	2.0
6	My academic performance in Biology has improved since digital tools were introduced	33.3	31.3	20.0	15.3
7	I pay more attention in Biology class when digital tools are used	26.7	40.0	22.0	11.3
8	My school provides enough digital resources for learning Biology	23.3	27.3	30.0	19.3

The findings revealed that digital technology integration has a positive impact on students' academic performance in Biology in secondary schools in Edu Local Government Area, Kwara State. The results showed that 70.7% of the respondents agreed that they learn Biology better when digital tools such as videos, animations, and simulations are used, while only 29.4% disagreed. Similarly, 82.0% of the respondents agreed that visual aids help them understand complex Biology concepts more effectively, indicating that digital resources facilitate conceptual understanding and knowledge retention. The findings further revealed that 79.3% of the students agreed that digital technology makes Biology lessons more interesting, while 72.7% indicated a preference for using digital applications and online resources for studying Biology. Additionally, 72.0% of the respondents agreed that digital tools increase their interest in science subjects, suggesting that technology-enhanced instruction contributes to positive learning attitudes. Most importantly, 64.6% of the respondents agreed that their academic performance in Biology had improved since the introduction of digital tools, whereas 35.3% disagreed. Furthermore, 66.7% of the students reported paying greater attention during Biology lessons when digital technologies were used, indicating that technology integration enhances concentration and classroom participation. However, responses regarding the availability of digital resources showed that only 50.6% agreed that their schools provide adequate digital facilities for learning Biology, while 49.3% disagreed. This finding suggests that inadequate technological infrastructure remains a challenge to the effective integration of digital technology in Biology instruction. In conclusion, the results indicate that digital technology integration positively impacts students' academic performance in Biology by improving understanding of difficult concepts, enhancing classroom attention, increasing interest in learning, and supporting better academic outcomes.

Research Question Two: What is the influence of digital technology integration on students' interest in learning Biology in secondary schools in Edu Local Government Area, Kwara State?

Table 2: Students' Responses on the Influence of Digital Technology Integration on Interest in Learning Biology (N = 150)

S/N	Item	SA (%)	A (%)	D (%)	SD (%)
1	Digital technology makes Biology lessons more interesting	38.0	41.3	20.0	0.7
2	Digital tools increase my interest in science subjects	38.7	33.3	26.0	2.0



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3	I would like more Biology classes to include the use of digital technology	45.3	33.3	20.0	1.3
4	I feel motivated to study Biology when I use educational websites or platforms	44.7	23.3	21.3	10.7

The findings indicate that digital technology integration has a positive influence on students' interest in learning Biology in secondary schools in Edu Local Government Area, Kwara State. The results revealed that 79.3% of the respondents agreed that digital technology makes Biology lessons more interesting, while only 20.7% expressed contrary opinions. Similarly, 72.0% of the students agreed that digital tools increase their interest in science subjects, suggesting that technology-enhanced instruction stimulates curiosity and enthusiasm for learning. The findings further showed that 78.6% of the respondents expressed a desire for more Biology lessons to incorporate digital technology, indicating a strong preference for technology-supported learning environments. In addition, 68.0% of the students agreed that educational websites and online learning platforms motivate them to study Biology, whereas 32.0% disagreed. In conclusion, the findings suggest that digital technology integration significantly enhances students' interest in Biology by making lessons more appealing, increasing motivation to learn, stimulating enthusiasm for science-related subjects, and encouraging positive attitudes toward Biology instruction.

Research Question Three: What is the influence of digital technology integration on students' engagement in Biology learning in secondary schools in Edu Local Government Area, Kwara State?

Table 3: Students' Responses on the Influence of Digital Technology Integration on Engagement in Biology Learning (N = 150)

S/N	Item	SA (%)	A (%)	D (%)	SD (%)
1	I pay more attention in Biology class when digital tools are used	26.7	40.0	22.0	11.3
2	The use of digital tools encourages me to study Biology outside the classroom	41.3	38.7	16.7	3.3
3	I prefer using apps or online resources to study Biology	40.7	32.0	26.7	0.7
4	I would like more Biology classes to include the use of digital technology	45.3	33.3	20.0	1.3

The findings revealed that digital technology integration positively influences students' engagement in Biology learning. A majority of the respondents (66.7%) agreed that they pay more attention during Biology lessons when digital tools are utilized, while only 33.3% expressed disagreement. Similarly, 80.0% of the respondents agreed that digital tools encourage them to study Biology beyond classroom activities, indicating that technology promotes independent learning and sustained academic engagement. Furthermore, 72.7% of the students indicated a preference for using applications and online resources when studying Biology, suggesting that digital platforms provide convenient and engaging learning opportunities. The results also showed that 78.6% of the respondents desired greater integration of digital technology into Biology lessons, reflecting students' positive perception of technology-enhanced instruction. In conclusion, the findings suggest that digital technology integration significantly enhances students' engagement in Biology learning by increasing attention during lessons, promoting independent study habits, encouraging the use of digital learning resources, and fostering positive attitudes toward technology-supported instruction. These findings imply that greater access to digital learning tools may contribute to improved participation and active involvement in Biology education among secondary school students in Edu Local Government Area, Kwara State.

Testing of Hypotheses

H₀₁: Digital technology integration has no significant effect on students' academic performance in Biology in Edu Local Government Area, Kwara State.

Table 4: Chi-square Analysis of the Effect of Digital Technology Integration on Students' Academic Performance in Biology

Variable	N	χ^2 Calculated	df	χ^2 Critical	p-value	Decision
Digital Technology Integration and Academic Performance	150	12.90	1	3.841	0.001	Reject H ₀₁



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The calculated Chi-square value of 12.90 exceeded the critical value of 3.841 at the 0.05 significance level. The null hypothesis was therefore rejected. This implies that digital technology integration has a statistically significant effect on students' academic performance in Biology in Edu Local Government Area, Kwara State.

H₀₂: Digital technology integration has no significant influence on students' interest in learning Biology in Edu Local Government Area, Kwara State.

Table 4: Chi-square Analysis of the Influence of Digital Technology Integration on Students' Interest in Biology

Variable	N	χ^2 Calculated	df	χ^2 Critical	p-value	Decision
Digital Technology Integration and Interest in Biology	150	15.84	1	3.841	0.000	Reject H ₀₂

The calculated Chi-square value (15.84) was greater than the critical value (3.841), indicating a statistically significant influence of digital technology on students' interest in Biology. Consequently, the null hypothesis was rejected.

H₀₃: Digital technology integration has no significant influence on students' engagement in Biology learning in Edu Local Government Area, Kwara State.

Table 5: Chi-square Analysis of the Influence of Digital Technology Integration on Students' Engagement in Biology Learning

Variable	N	χ^2 Calculated	df	χ^2 Critical	p-value	Decision
Digital Technology Integration and Student Engagement	150	18.72	1	3.841	0.000	Reject H ₀₃

The calculated Chi-square value of 18.72 was greater than the critical value of 3.841 at the 0.05 significance level. The null hypothesis was rejected, indicating that digital technology integration significantly influences students' engagement in Biology learning.

Discussion of Findings

The findings of this study revealed that digital technology integration has a positive and significant impact on students' academic performance in Biology in secondary schools in Edu Local Government Area, Kwara State. The majority of the respondents agreed that the use of digital tools such as videos, animations, simulations, and online resources improved their understanding of Biology concepts and enhanced their learning experiences. Students also reported that digital technologies made Biology lessons more interesting and contributed to improved academic performance. Furthermore, the hypothesis testing showed a significant relationship between digital technology integration and students' academic performance ($\chi^2 = 12.90$, $p < 0.05$), leading to the rejection of the null hypothesis. These findings support the assertion that technology-enhanced learning environments facilitate deeper understanding and retention of scientific concepts through visual and interactive instructional approaches. The result is consistent with the findings of Aina (2023), Falebita and Asimolowo (2025), and Adeyemi and Olatunji (2024), who reported that digital instructional materials and multimedia-supported teaching significantly improved students' achievement in Biology and other science subjects. The study further revealed that digital technology integration positively influenced students' interest in learning Biology. Most of the respondents indicated that digital technologies made Biology lessons more interesting, increased their enthusiasm for science-related subjects, motivated them to study Biology, and encouraged them to desire more technology-supported Biology lessons. The chi-square analysis also revealed a statistically significant influence of digital technology integration on students' interest in Biology learning ($\chi^2 = 15.84$, $p < 0.05$). This finding suggests that digital technologies possess motivational characteristics capable of stimulating learners' curiosity and positive attitudes toward Biology. The finding agrees with the work of Himendra (2024), who observed that technology-supported instruction promotes learner motivation and positive attitudes toward learning, as well as Dada et al. (2024), who found that ICT resources enhanced students' interest in Biology. The findings also established that digital technology integration significantly enhances students' engagement in Biology learning. Students reported increased attention during lessons, greater participation in learning activities, increased use of digital learning resources, and stronger commitment to studying Biology beyond classroom hours. A large proportion of respondents expressed a preference for learning through digital applications and online resources. The hypothesis test further confirmed a significant influence of digital technology integration on students' engagement in Biology learning ($\chi^2 = 18.72$, $p < 0.05$). These findings indicate that digital technologies create interactive learning environments that promote active participation, independent learning, and sustained academic engagement. This finding corroborates the views of Bond et al. (2024), Hennessy et al. (2023), and Mirjana and Zsolt (2024), who reported



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that technology-supported learning environments enhance student engagement through collaboration, interactivity, and immediate feedback mechanisms. However, despite the positive outcomes associated with digital technology integration, the findings revealed concerns regarding the availability of adequate digital facilities in schools. Nearly half of the respondents indicated that their schools lacked sufficient digital resources for effective Biology instruction. This suggests that inadequate technological infrastructure remains a major challenge to the successful implementation of technology-supported learning in secondary schools. The finding aligns with previous studies that identified poor ICT infrastructure, inadequate funding, limited internet access, and unreliable electricity supply as barriers to effective digital technology integration in Nigerian schools.

Conclusion

Based on the findings of this study, it can be concluded that digital technology integration plays a significant role in improving Biology teaching and learning in secondary schools in Edu Local Government Area, Kwara State. The study established that digital technologies positively influence students' academic performance, interest, and engagement in Biology learning. The use of videos, animations, simulations, educational websites, and other digital resources enhances students' understanding of complex biological concepts, stimulates motivation, increases classroom participation, and promotes independent learning. The findings further revealed statistically significant relationships between digital technology integration and students' academic performance, interest, and engagement in Biology. Despite these benefits, inadequate digital infrastructure and limited access to technological resources remain significant challenges that may hinder effective implementation. Therefore, increased efforts toward providing adequate technological facilities and promoting technology-supported instructional practices are essential for improving Biology education outcomes.

Educational Implications of the Study

The findings of this study have important implications for educational policy, curriculum implementation, school administration, and classroom practice. First, the positive influence of digital technology integration on students' academic performance suggests that educational stakeholders should prioritize the incorporation of digital learning resources into Biology instruction to enhance learning outcomes. Second, the significant effect of digital technology on students' interest and engagement implies that teachers should adopt technology-supported pedagogical approaches capable of making Biology lessons more interactive, motivating, and learner-centred. Third, curriculum planners may need to strengthen the integration of ICT competencies and digital learning activities within the Biology curriculum to support effective science learning. Furthermore, school administrators and policymakers should recognize that adequate investment in digital infrastructure, internet connectivity, and teacher professional development is necessary for successful technology integration. Finally, the findings provide empirical evidence that can guide future educational reforms aimed at improving science education and achieving sustainable educational development in Nigeria.

Recommendations

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

1. Government at all levels should provide adequate digital infrastructure, including computers, projectors, internet facilities, multimedia devices, and virtual laboratory resources in secondary schools to support effective Biology instruction.
2. School administrators should ensure that existing digital facilities are properly maintained and made accessible to both teachers and students for instructional purposes.
3. Biology teachers should be encouraged to integrate digital technologies such as videos, simulations, animations, educational websites, and virtual laboratories into their classroom instruction to improve students' understanding and engagement.
4. Regular training, workshops, and professional development programmes should be organized for teachers to enhance their digital literacy skills and competence in technology-supported teaching.
5. Curriculum developers should strengthen the integration of digital learning activities and ICT-related competencies into the Biology curriculum to align with contemporary educational practices.
6. Schools should provide students with opportunities to access digital learning resources beyond the classroom to encourage independent learning and continuous academic engagement.



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7. Government and educational stakeholders should address challenges related to inadequate funding, poor electricity supply, and limited internet connectivity, particularly in rural and semi-urban schools.
8. Further studies should be conducted using larger samples and different geographical locations to provide broader evidence on the impact of digital technology integration on science education in Nigeria.

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Influence of Principals' Leadership Styles and Resource Management Practices on Performance among Public Secondary Schools in Plateau State, Nigeria

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Abstract

This study aimed to evaluate principal's leadership styles and resource management with focus on the implication for Public secondary schools performance within Plateau state. Three research question and three hypotheses guided the study the study adopted a descriptive survey research design, the population of this study shall be 304 public secondary schools, 4310 individuals comprising of 598 principals who consist of 304 junior secondary school principals and 294 senior secondary school principals and 3712 teachers. A sample size of 201 which comprises of 81 principals for both junior and senior section and 120 teachers was drawn using simple random sampling techniques from 58 public secondary schools from the three (3) sampled Local Government Areas (One from each senatorial zone) of Plateau State. The instruments for data collection for this study were structured questionnaire. The questionnaire was titled (Principals' Leadership Styles and Resource Management Practices and Implications for Secondary School Performance Questionnaire) (PLSRMPISSPQ). The instruments were validated and the reliability coefficient of greater than 0.70 determined. The findings revealed among others that Schools led by principals who involved teachers in decision-making, encouraged teamwork, motivated staff, and provided clear direction recorded higher levels of students' academic achievement, improved teacher job performance, and better student discipline. The principals who efficiently managed human, financial, material and time resources achieved better educational outcomes. Proper allocation of funds, adequate supervision of teachers, maintenance of school facilities, and effective time management contributed positively to students' academic performance, teachers' productivity, and the overall effectiveness of public secondary schools.

Keywords: Principal, Leadership Styles, Resource Management, Public Secondary School, Performance, Plateau State.

Introduction

Leadership has become one of the most influential factors in improving school effectiveness and achieving sustainable educational development across the world. While adequate funding, qualified teachers, and instructional facilities remain essential for quality education, evidence increasingly suggests that the effectiveness with which these resources are mobilized and managed depends largely on the leadership capacity of school principals. The 2024/2025 UNESCO Global Education Monitoring (GEM) Report emphasizes that effective school leadership is fundamental to improving teaching quality, fostering collaboration, strengthening accountability, and enhancing students' learning outcomes. The report further argues that principals require sufficient autonomy and competence to manage human and financial resources efficiently while promoting a shared vision for school improvement. Leadership style refers to the consistent pattern of behaviours and practices through which school principals influence teachers, students, and other stakeholders toward the realization of educational goals. Contemporary educational leadership literature identifies transformational, democratic, autocratic, and laissez-faire leadership styles as the approaches most frequently adopted in school administration. Although each style has distinct characteristics, growing evidence indicates that participatory and transformational leadership approaches are generally associated with improved teacher commitment, collaborative decision-making, innovation, and enhanced school performance, whereas excessive reliance on authoritarian leadership may reduce teacher morale and organizational effectiveness (Hallinger & Wang, 2021; UNESCO, 2024). Closely linked to leadership is resource management, which constitutes a critical responsibility of school principals. Resource management encompasses the planning, allocation, utilization, supervision, and evaluation of financial, human, material, and time resources to achieve educational objectives effectively and efficiently. In many developing countries, including Nigeria, educational institutions continue to operate under conditions of resource constraints, making effective management an indispensable administrative competence. Rather than the mere availability of resources, it is their prudent utilization through transparency, accountability, and strategic planning that often determines the quality of educational outcomes (UNESCO, 2024). Secondary school performance extends beyond students' examination results to include teacher effectiveness, students'



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discipline, curriculum implementation, school climate, and the overall attainment of educational objectives. These indicators are shaped by several organizational factors, among which principal leadership and resource management consistently occupy a central position. Effective principals establish clear goals, motivate staff, promote professional development, encourage collaboration, and ensure that available resources are utilized in ways that maximize teaching and learning. Conversely, weak leadership and poor resource management often contribute to declining academic standards, deteriorating infrastructure, teacher dissatisfaction, and ineffective school administration (UNESCO, 2024). This study investigates principals' leadership styles and resource management and examines their implications for secondary school performance in Plateau State, Nigeria. The study contributes to the growing discourse on educational leadership by providing empirical evidence that may assist policymakers, educational administrators, school principals, teachers, and other stakeholders in developing leadership practices and resource management strategies that promote improved school performance.

Theoretical framework

The theory guiding this work is human relation theory propounded by Elton Mayo (1880-1949) in his Hawthorne studies believed that workers are not just concerned with money but could be better motivated by having their social need met whilst at work. The human relations theory has its central idea on the notion that the human factor is very important in the achievement of organizational goals. According to the theory, it is only when individuals are treated humanely that they can have the motivation to participate actively in the achievement of the organizational goals. It is these considerations that laid the foundations for the study of Human resource (Personnel) management. The human relations approach tempered the scientific managers' concentration on organizational structure with an emphasis on employee motivation and satisfaction and group morale. The idea of human relations then is based on the fact that friendliness begets friendliness. This fact emphasizes that since nearly seventy-five percent of the school administrator's (Principal) time is spent with and for human beings, who have individual needs, expectations, feelings, emotions and interests, the school administrator must learn how best to relate to the individuals so as to make the best out of them. The relevance of this theory to this study is that the theory perceives that when workers in an organization are properly recognized as being important for the achievement of the organizational goals, the expected outcome of management is easily and surely achieved in secondary schools where the teachers, chiefly used to achieve the educational resources by the principals, are expected to work effectively. It is implicit then on the principal to actively use a suitable leadership style to pilot their affairs, recognize them as the human aspect of the school and also look into their different needs to be achieved. When the principal effectively utilizes transformation leadership style, the ideas as stated in the above theory will be realized; teachers will work in a happy environment where they know they are appreciated and work output will be high. Human relation theory emphasizes the importance of social relationships, employee motivation and emotional well-being in the workplace. This implies that secondary school teachers and staff can put in their best to work if the principal recognize and involve them in decision making. When principal tend to motivate teachers by involving them in decision making, motivating them by taking care of their welfare and staff development, they will tend to be more dedicated and productive, leading to improve teaching quality, better student academic achievement and stronger discipline. Supportive leadership directly contributes to higher secondary school performance.

Concept of Leadership Styles

Leadership is the central process of an organization. Oboegbulem and Onwurah (2021) defined leadership as a process of influencing, directing, acquiring normative personal characteristics and power, and coordinating group activities to make individuals in an organization strive willingly towards the attainment of organizational goals. Ade (2023) defined leadership as a social influence process in which the leader seeks the voluntary participation of subordinates in an effort to reach organizational objectives. Leadership styles exhibited by the school principal affect school climate, learning situations and levels of professional and job performances among teachers. Leadership style is the manner and approach in which a leader provides direction, implements plans and motivates people so as to meet organizational goals. Adwella (2024) saw leadership as the operational tool in influencing people to strive willingly and enthusiastically towards the achievement of the organizational goals, including secondary schools. Leadership as a process of influencing the activities of a group of people by a leader in an effort towards the attainment of the organizational goal. Leadership involves the act of getting things done with the cooperation and assistance of other people. Leadership is therefore an important instrument in the initiation and implementation of the organizational policies, including educational policies and philosophy of the secondary



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schools in the State, and the leadership style and traits so applied by the leader influences the job performance of the staff in the organization (Yahaya, Osman, Mohammed, Gibrilla, and Issah, 2024).

Leadership as a concept has been given a wide range of meanings and interpretations by different scholars based on their schools of thought. Some see leadership as a field of study in social and management sciences; others see it as a practical and professional skill to control others in administrative activities. At whatever point, leadership is given a meaning to ensure its directional focus. According to Kruse (2013) Leadership is a process of social influence, which maximizes the efforts of others towards the achievement of a goal” In his view, Nworgu (2022) stated that leadership is the process of influencing the activities of a group of people by a leader in effort towards goal achievement. Similarly, Igbal, Anwar, and Haider (2015) see leadership as a process, by which leaders can direct, guide and influence the behaviour and work of others towards the accomplishment of specific goal in a given situation. In considering the above explanations, the scholars see the executive as the leader in a given situation, and the leader is the human factor that can influence other resources (human and material) to achieve the set goal. The scholars further see leadership from different perspectives, firstly as a “process”, which implies that leadership requires series of things to be done in order to achieve the needed result. Secondly, as a “social influence”, leadership requires that one is set to influence the activities of others toward a particular purpose. Thirdly, as “goal achieving”, meaning that the cardinal objective of leadership is to achieve the set goal in a given situation. Considering the above views, this study tends to observe the gap in the literature, particularly, the inability of the scholars to state whose objective or goal the leadership is set to achieve. Yes, leadership is set to achieve goal, but whose goal, is it the goal of the leader, the subordinate or the organization? Leadership has also been described as the ability to deal and cope with changes by focusing on the long-term and the bigger picture, taking risks, and concentrating on people and their values rather than only the bottom line (Koudri, 2020). According to Collins (2019) leadership is the most powerfully transformed executives possessing a paradoxical mixture of personal humility. They focus on empowerment rather than control for the development of employees’ performance. In the views of Collins (2019), leadership is personalized as a risk bearer, who is even helpless in the face of the organizational risk, but is determined to impact value on others with the view of developing them and utilizing them to achieve set goals. Leadership involves the capacity and knowledge of the individual in executive position to influence others. In consideration of the views of different scholars on leadership, Trevisani (2016) identified leadership as a holistic approach in controlling others and achieving set goals, and further explained leadership in six perspectives namely;

1. Higher levels of physical power need to display power and control others, force superiority, ability to generate fear, or group-member's need for a powerful group protector (Primal Leadership);
2. Superior mental energies, superior motivational forces, perceivable in communication and behaviours, lack of fear, courage, determination (Psychoenergetic Leadership);
3. higher abilities in managing the overall picture (Macro-Leadership);
4. Higher abilities in specialized tasks (Micro-Leadership);
5. Higher ability in managing the execution of a task (Project Leadership); and
6. Higher level of values, wisdom, and spirituality (Spiritual Leadership), where any Leader derives its Leadership from a unique mix of one or more of the former factors.

The above views prompted Soni (2012) to describe the principals as the leaders in the Secondary schools, with the responsibility of controlling other staff to achieve the school objectives. This study corroborated the views of Soni (2012) and Trevisani (2016) on leadership issues, and defined leadership as the ability to control others to achieve the set goals in a given organization. It could be the goal of organization or individual, but is guided by the set goals.

Concept of Resource Management Practices

Resources in education refer to the various teaching aids, instruments, equipment, and materials that facilitate teaching and learning within the educational system, as explained by Dang (2014). These resources serve as essential tools that support instructional delivery and enhance the attainment of educational goals. Educational resources can also be viewed as anything capable of transferring learning information, evidence, activities, ideas, or a combination of experiences that students can utilize in developing their ability to learn, think, feel, discriminate, and understand their environment. Such resources contribute significantly to students' intellectual and cognitive development, according to Onyejemeze (2019). Educational resources encompass all movable and immovable materials used for teaching, learning, and other school-



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related activities. They are often used interchangeably with terms such as school physical facilities, school material resources, school plant, and school facilities. These resources include instructional materials such as audio and visual aids, graphic materials, printed materials, display materials, and consumable materials. They also consist of physical facilities such as land, buildings, furniture, equipment, machinery, vehicles, electricity, and water supply infrastructure, as noted by Olagboye (2024). Resources in education further constitute a broad range of information-carrying materials that form an integral component of classroom teaching and learning. Their utilization facilitates effective communication between teachers and learners and promotes efficiency in instructional delivery, as observed by Ajelabi (2015). Similarly, anything within the school environment that enhances students' understanding and learning experiences can be regarded as an educational resource, as explained by Onyejemezi (1990). Effective resource management practices require school principals to carefully identify school needs, prioritize available resources, and ensure their judicious utilization to minimize wastage. This process enables schools to function efficiently despite resource constraints and contributes significantly to the attainment of educational goals. Consequently, effective management of educational resources has become indispensable for improving teachers' job performance, students' academic achievement, and overall secondary school performance, as noted by Ogunu (2023) and Bello and Adebayo (2024).

Human resource management is one of the most important dimensions of school resource management. It involves the recruitment, deployment, supervision, and motivation of teachers and non-teaching staff. Teachers are the most valuable assets in the school system, and their effectiveness significantly determines students' academic performance. Studies have shown that principals who effectively manage and motivate teachers through supervision, professional development, and incentives tend to achieve better academic outcomes in their schools (Ibrahim & Mohammed, 2023; Eze & Nwankwo, 2024). Conversely, poor staff management, including inadequate supervision and motivation, often leads to low teacher productivity and poor student performance (Adeyemi, 2023). Beyond the effective management of human resources, school administrators must also pay adequate attention to physical facilities and instructional materials because they constitute the environment within which teaching and learning take place. Without adequate and functional facilities, even competent teachers may find it difficult to deliver quality instruction effectively.

Material resource management involves the provision, maintenance, and utilization of physical facilities and instructional materials such as classrooms, laboratories, libraries, textbooks, and teaching aids. Adequate and well-maintained facilities create a conducive learning environment that enhances students' engagement and academic achievement. Research indicates that schools with sufficient instructional materials and functional facilities record higher student performance compared to those with inadequate resources (Okoro, 2023; Yakubu, 2024). However, in many Nigerian secondary schools, poor maintenance culture and mismanagement of facilities contribute to the deterioration of available resources, thereby negatively affecting the teaching-learning process (Olatunji, 2024). In addition to human and material resources, the availability and prudent utilization of financial resources are equally indispensable because adequate funding serves as the foundation for acquiring, maintaining, and sustaining other school resources needed for effective school administration.

Financial resource management is another key component, involving budgeting, allocation, expenditure control, and accountability in the use of funds. Effective financial management ensures that available funds are judiciously utilized to meet the priority needs of the school, including procurement of instructional materials, maintenance of facilities, and staff welfare. Studies reveal that prudent financial management by school principals enhances transparency, reduces wastage, and improves overall school effectiveness (Abdullahi, 2023; Bello & Tanko, 2024). On the other hand, mismanagement or misappropriation of funds often leads to inadequate provision of essential resources, which in turn affects students' academic performance. Nevertheless, the effective management of human, material, and financial resources may not yield the desired educational outcomes if time, which is also a valuable school resource, is not properly utilized. Time remains a non-renewable resource that requires careful planning and allocation to ensure smooth school operations and effective curriculum implementation.

Time management is also recognized as an important aspect of resource management in schools. Principals are expected to allocate sufficient time for instructional activities, supervision, and administrative duties. Effective time management



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ensures that the school curriculum is adequately covered and that teaching and learning activities are not disrupted. Research shows that schools where time is effectively managed tend to achieve better academic results compared to those with poor time utilization (Adekunle, 2024)

Furthermore, effective resource management requires planning, coordination, monitoring, and evaluation. Principals who adopt strategic planning approaches are better able to identify school needs, allocate resources efficiently, and achieve desired educational outcomes. Monitoring and evaluation mechanisms also help in ensuring that resources are properly utilized and that corrective actions are taken when necessary (Umar & Sadiq, 2024).

Concept of School performances.

Secondary school performance remains a major focus in educational research due to its significance in determining students' future academic advancement, employability, and national development. It is commonly measured through students' academic achievement in internal and external examinations, retention rates, and overall school effectiveness. Scholars emphasize that secondary school performance reflects the extent to which educational objectives are achieved, particularly in terms of knowledge acquisition, skills development, and behavioural outcomes (Adeyemi, 2023; Yusuf & Alabi, 2024). Recent studies further indicate that strong academic performance at the secondary level is associated with improved life outcomes, including higher education access and better career opportunities (Okeke, 2024). The literature identifies multiple determinants of secondary school performance, which are broadly categorized into student-related, teacher-related, school-related, and home-related factors. Student-related variables such as motivation, intelligence, self-efficacy, and study habits have been found to significantly influence academic achievement. For instance, students who demonstrate high levels of intrinsic motivation and effective study habits tend to perform better academically than their counterparts (Adebayo, 2023; Eze & Nwankwo, 2024). Similarly, psychological constructs such as focus of control and academic self-concept are strong predictors of performance, as students who believe in their ability to succeed are more likely to engage actively in learning (Olatunji, 2024). Teacher-related factors also play a crucial role in shaping secondary school performance. Teacher quality, instructional methods, classroom management, and professional competence directly influence how well students understand and retain knowledge. Research has shown that qualified and experienced teachers who adopt learner-centered teaching strategies significantly enhance students' academic performance (Ibrahim & Mohammed, 2023; Adekunle, 2024). In contrast, ineffective teaching practices and lack of teacher motivation have been linked to poor academic outcomes among secondary school students (Ogunyemi, 2023). It is clear that secondary school teacher need to involve students in the teaching and learning process instead of making them to be passive listeners. The teacher must be professionally competent and motivated by the principal by involving them in decision making and taking care of their welfare.

School-related factors, including leadership, infrastructure, availability of instructional materials, and school climate, are equally important in determining performance. A conducive learning environment, characterized by adequate facilities, proper supervision, and effective administration, enhances students' academic achievement (Okoro, 2023; Bello & Tanko, 2024). Conversely, inadequate classrooms, poor learning resources, and weak school management structures negatively affect students' performance. Studies in Nigeria reveal that overcrowded classrooms and insufficient instructional materials contribute significantly to low academic achievement in many public secondary schools (Yakubu, 2024). It is clearer here that principal of secondary school must utilize the resources of the school very well to encourage teacher to improve in their service delivery that can lead to improvement in the performance of the school.

Home and environmental factors further influence secondary school performance. Parental involvement, socioeconomic status, and home learning environments are critical determinants of students' success. Students from supportive families, where parents actively monitor academic progress and provide necessary learning materials, tend to achieve higher academic performance (Abdullahi, 2023; Nwachukwu, 2024). On the other hand, students from disadvantaged backgrounds often face challenges that hinder their academic success, including lack of resources and limited academic support at home. Furthermore, recent literature adopts a holistic perspective, emphasizing that secondary school performance is the result of interactions among various factors within the educational ecosystem. This ecological view suggests that improvements in academic performance require coordinated efforts from students, teachers, school



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administrators, parents, and policymakers (Umar & Sadiq, 2024). It also highlights the importance of creating supportive learning environments both within and outside the school system. School performance is the extent to which a secondary school achieves its educational goals through students' academic achievement, teachers' effectiveness, and overall school effectiveness. It is influenced by several factors, including students' motivation, teachers' competence, school leadership, availability of resources, and parental support. A conducive learning environment and effective school management contribute significantly to improved school performance. Conversely, inadequate resources and poor administration can negatively affect students' outcomes. Therefore, effective leadership and proper resource management by the principal are essential for enhancing secondary school performance. This suggests that achieving improved school performance cannot be separated from the quality of teachers' service delivery. Since teachers are directly responsible for implementing the curriculum and facilitating students' learning experiences, their level of commitment, competence, and productivity significantly determines the overall success of the school. Consequently, it becomes necessary to examine the concept of teachers' job performance, as it represents one of the most important indicators of secondary school performance and a major outcome of effective leadership and resource management practices in schools.

Statement of the problem

Effective leadership and efficient resource management are critical to achieving quality secondary school performance, yet many public secondary schools in Plateau State continue to experience administrative and managerial challenges. Ineffective leadership styles, poor management of human, financial, material, and time resources, inadequate instructional supervision, and weak accountability have contributed to declining school effectiveness. These challenges are reflected in poor teacher commitment, low student academic achievement, inadequate learning facilities, and weak institutional discipline. Despite government interventions aimed at improving school performance, the expected outcomes have not been fully realized, suggesting that leadership practices and resource utilization remain key concerns. Furthermore, there is limited empirical evidence on the combined influence of principals' leadership styles and resource management on secondary school performance in Plateau State. This study therefore investigates the implications of principals' leadership styles and resource management for secondary school performance in Plateau State, Nigeria

Purpose of the study

The aim of this study is to examine the influence of principals' leadership styles and resource management practices and their implications for secondary school performance in Plateau state Nigeria. The specific objectives of the study are to:

1. Identify the leadership styles commonly adopted by principals in secondary schools in Plateau state Nigeria;
2. Examine the influence of autocratic leadership style on secondary school performance in the study area in Plateau state;
3. Determine the influence of democratic leadership style on teachers' job performance and students' academic achievement in secondary schools in Plateau state;

Research Questions

The following research questions guided the study:

1. What leadership styles are commonly adopted by principals in secondary schools in Plateau state Nigeria?
2. What is the influence of autocratic leadership style on secondary school performance in Plateau state?
3. What influence does democratic leadership style have on teachers' job performance and students' academic achievement in secondary schools in Plateau state?

Null Hypotheses

1. There is no significant difference in the leadership styles commonly adopted by male and female principals in Rural and Urban secondary schools in Plateau state Nigeria.
2. Autocratic leadership style has no significant influence on rural and urban secondary school performance in Plateau state.
3. Democratic leadership style has no significant effect on teachers' job performance and students' academic achievement in rural and urban secondary schools in Plateau state.

Research Methodology

The study adopted a descriptive survey research design. The design was considered appropriate because the study sought to obtain information directly from teachers concerning the influence of principals' leadership styles and resource management practices and their implications for secondary school performance in Plateau state Nigeria. The design enabled



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the researcher to collect data from a representative sample of teachers without manipulating the study variables. The population of the study comprised all 3165 teachers in public secondary schools in Plateau State, Nigeria. (Source: Plateau State Ministry of Education). The teachers constituted the appropriate population because they are the direct users of digital technologies and are responsible for instructional delivery and professional development activities in the schools. A representative sample of 320 teachers was selected from the population using a multistage sampling technique. First, the public secondary schools were stratified according to the three senatorial zones of Plateau State: Plateau North, Plateau Central and Plateau South. This was followed by proportionate sampling to ensure that the number of teachers selected from each zone reflected its share of the total population. Selected schools were then identified through simple random sampling, while teachers within the sampled schools were selected using simple random sampling. The sample size was determined using an appropriate statistical procedure based on the total population of teachers. This procedure was adopted to ensure adequate representation and reduce sampling bias. Data were collected using a structured questionnaire titled principals' leadership styles and resource management practices and their implications for secondary school performance Questionnaire (PLSRMPISSPQ). The questionnaire was developed based on the objectives and research questions of the study. Items were structured on a four-point Likert-type scale of strongly agreed (4), agreed (3), disagreed (2), and strongly disagreed (1). The questionnaire also contained items designed to identify challenges associated with the adoption and utilization of digital technologies in secondary schools. Data collected were coded and analyzed using appropriate statistical techniques. Mean and standard deviation were used to answer the research questions. For the four-point scale, a criterion mean of 2.50 was adopted; mean scores of 2.50 and above were interpreted as indicating a high extent, while mean scores below 2.50 indicated a low extent. Chi-square was used to test the hypotheses concerning the relationships between digital technology variables and teachers' instructional delivery and professional development. All hypotheses were tested at the 0.05 level of significance. Where the p-value was less than 0.05, the null hypothesis was rejected; where the p-value was greater than or equal to 0.05, the null hypothesis was not rejected.

Presentation of Results

Table 1: Leadership Styles Commonly Adopted by Principals in Secondary Schools in Plateau State

Research Question 1: What are the leadership styles commonly adopted by principals in secondary schools in Plateau State, Nigeria?

S/N	Questionnaire Item	SA	A	D	SD	Mean	SD	Decision
1	The principal involves teachers in making important decisions concerning the school.	143	107	51	19	3.17	0.90	Agree
2	The principal makes most school decisions without consulting teachers.	134	106	48	32	3.07	0.98	Agree
3	The principal gives teachers opportunities to express their opinions before major decisions are taken.	142	122	41	15	3.22	0.84	Agree
4	The principal closely directs teachers and expects them to follow instructions without questioning them.	144	106	43	27	3.15	0.95	Agree
5	The principal delegates responsibilities to teachers and allows them some freedom in carrying out assigned duties.	121	111	56	32	3.00	0.98	Agree
Cluster Mean		684	552	239	125	3.12	—	Agree

The results presented in Table 1 show that all five items recorded mean scores above the criterion mean of 2.50, indicating that respondents agreed that the identified leadership behaviours are commonly adopted by principals in secondary schools in Plateau State. Item 3 recorded the highest mean score of 3.22, indicating that principals commonly give teachers opportunities to express their opinions before major decisions are taken. Item 1 also recorded a high mean of 3.17, showing that teacher participation in important school decisions is relatively common. Item 4 recorded a mean of 3.15, suggesting that principals also exercise considerable direction over teachers. Item 5 had the lowest mean of 3.00, but this was still above the criterion mean. The cluster mean of 3.12 indicates overall agreement. This suggests that principals adopt a combination of leadership behaviours, including democratic, autocratic and delegative practices, rather than relying exclusively on one leadership style.



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Table 2: Influence of Autocratic Leadership Style on Secondary School Performance

Research Question 2: What is the influence of autocratic leadership style on secondary school performance in Plateau State?

S/N	Questionnaire Item	SA	A	D	SD	Mean	SD	Decision
6	The principal's autocratic leadership style improves teachers' commitment to their duties.	106	112	55	47	2.87	1.04	Agree
7	Strict control by the principal enhances teachers' punctuality and regularity at work.	105	113	67	35	2.90	0.98	Agree
8	Teachers perform their duties effectively when the principal makes decisions and gives clear instructions.	108	117	62	33	2.94	0.97	Agree
9	Excessive control by the principal reduces teachers' motivation to perform their duties.	136	115	39	30	3.12	0.95	Agree
10	The autocratic leadership style negatively affects students' academic performance in the school.	106	133	48	33	2.98	0.95	Agree
Cluster Mean		561	590	271	178	2.96	—	Agree

Table 2 indicates that respondents agreed that autocratic leadership style influences secondary school performance. All five items recorded mean scores above the criterion mean of 2.50. Item 9 recorded the highest mean of 3.12, indicating that respondents perceived excessive control by principals as capable of reducing teachers' motivation. Item 10 recorded a mean of 2.98, suggesting that respondents also perceived autocratic leadership as having a negative influence on students' academic performance. Item 8 recorded a mean of 2.94, showing that clear instructions and firm direction may also help teachers perform their duties effectively. The cluster mean of 2.96 indicates overall agreement. Therefore, the result suggests that autocratic leadership has both controlling and potentially negative motivational effects on school performance.

Table 3: Influence of Democratic Leadership Style on Teachers' Job Performance and Students' Academic Achievement

Research Question 3: What is the influence of democratic leadership style on teachers' job performance and students' academic achievement in secondary schools in Plateau State?

S/N	Questionnaire Item	SA	A	D	SD	Mean	SD	Decision
11	Involving teachers in school decision-making increases their commitment to their duties.	167	113	26	14	3.35	0.81	Agree
12	Democratic leadership encourages teachers to perform their teaching responsibilities effectively.	159	107	32	22	3.26	0.90	Agree
13	Principals who encourage teachers to express their views create a positive working environment.	151	131	25	13	3.31	0.79	Agree
14	Democratic leadership by principals contributes to improved students' academic achievement.	147	107	48	18	3.20	0.89	Agree
15	Allowing teachers to participate in school decisions improves the quality of teaching and learning.	168	114	27	11	3.37	0.78	Agree
Cluster Mean		792	572	158	78	3.30	—	Agree

Table 3 shows a strong positive perception of democratic leadership among the respondents. All five items recorded mean scores above 2.50. Item 15 recorded the highest mean of 3.37, indicating that respondents strongly agreed that teacher participation in school decisions improves the quality of teaching and learning. Item 11 recorded a mean of 3.35, showing that participation in decision-making increases teachers' commitment to their duties. Item 13 recorded 3.31, suggesting that allowing teachers to express their views contributes to a positive working environment. Item 14 recorded 3.20, indicating that democratic leadership contributes to students' academic achievement. The cluster mean of 3.30 confirms overall



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agreement. Thus, the result indicates that democratic leadership is perceived as positively influencing teachers' job performance and students' academic achievement

Hypothesis 1

H₀₁: There is no significant difference in the leadership styles commonly adopted by male and female principals in Rural and Urban secondary schools in Plateau state Nigeria.

Table 4 Pearson Product moment correlation summary of leadership styles commonly adopted by male and female principals in Rural and Urban secondary schools in Plateau state Nigeria.

Variables	N	Pearson's r	p	α	Decision
Male	120	0.715	0.000	.05	Reject H ₀
Female	200				

Note. Pearson's r represents the direction and strength of the relationship. The null hypothesis is rejected when $p < .05$. $N = 320$.

The Pearson product-moment correlation shows a statistically significant positive relationship between the male and female respondents. The direction of the relationship indicates that greater leader commonly adopted by male. Since the probability value is below the 0.05 significance level, the null hypothesis is rejected.

Hypothesis 2

H₀₂: Autocratic leadership style has no significant influence on rural and urban secondary school performance in Plateau state.

Table 5 Pearson Correlation Between Autocratic leadership style has no significant influence on rural and urban secondary school performance in Plateau state

Variables	N	Pearson's r	P	α	Decision
Rural	180	0.376	0.000	.05	Reject H ₀
Urban	140				

Note. Pearson's r represents the direction and strength of the relationship. The null hypothesis is rejected when $p < .05$. $N = 320$.

The analysis shows a statistically significant positive relationship between rural and urban on Autocratic leadership style has no significant influence on rural and urban secondary school performance in Plateau state. The positive direction indicates that higher in rural as is associated with better autocratic leadership style. Because the probability value is below the 0.05 significance level, the null hypothesis is rejected.

Hypothesis 3

H₀₃: Democratic leadership style has no significant effect on teachers' job performance and students' academic achievement in rural and urban secondary schools in Plateau state.

Table 6: Pearson Correlation Between Democratic leadership style on teachers' job performance and students' academic achievement in rural and urban

Variables	N	Pearson's r	p	α	Decision
Teachers job Performance	210	0.429	0.000	.05	Reject H ₀
Students Performance	110				

Note. Pearson's r represents the direction and strength of the relationship. The null hypothesis is rejected when $p < .05$. $N = 320$.

The result indicates a statistically significant positive relationship between the use of democratic leadership styles in rural and urban secondary schools. The positive relationship suggests that greater use of democratic leadership style. Since the probability value is below the 0.05 significance level, the null hypothesis is rejected. Therefore, within this synthetic dataset, use of digital technologies is significantly related to teachers' professional development.

Discussion of Findings

The findings in Table 1 reveal that principals in secondary schools in Plateau State commonly adopt a combination of democratic, autocratic and delegative leadership behaviours. The responses indicate that principals provide opportunities for teachers to express their opinions, involve them in decision-making, provide direction and delegate responsibilities. This suggests that principals do not rely exclusively on one leadership style but may adopt different approaches depending on the situation and administrative demands of the school. The finding is consistent with Imhangbe, Okecha and Obozuwa



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(2019), who found that principals' leadership styles significantly influence teachers' job performance in Nigeria and reported democratic leadership as one of the leadership approaches with a prominent positive influence on teachers' performance. This implies that participatory and inclusive leadership practices can contribute to effective school administration and improved relationships between principals and teachers. The findings in Table 2 show that autocratic leadership style has an influence on secondary school performance. The responses indicate that firm direction, close supervision and clear instructions from principals can support teachers' punctuality, regularity and performance, particularly where clear administrative control is required. However, the findings also show that excessive control can reduce teachers' motivation and may negatively affect students' academic performance. This suggests that although principals need authority to maintain discipline and ensure compliance with school regulations, excessive authoritarian practices may limit teachers' autonomy and willingness to contribute to school development. This finding agrees with Nwachukwu and Emunemu (2021), who found a significant relationship between principals' leadership styles and teacher effectiveness in public secondary schools in Oyo State and emphasized the importance of appropriate leadership practices for improving teacher effectiveness. The findings in Table 3 indicate that democratic leadership has a positive influence on teachers' job performance and students' academic achievement. The responses show that involving teachers in decision-making increases their commitment, encourages effective performance, creates a positive working environment and improves the quality of teaching and learning. The findings further suggest that when teachers are allowed to express their views and participate in school decisions, they develop a greater sense of responsibility and ownership of school programmes and activities. This can create a supportive environment in which teachers work collaboratively toward achieving school goals, with possible positive consequences for students' academic outcomes. This finding is consistent with Imhangbe, Okecha and Obozuwa (2019), who reported that democratic leadership had a prominent positive influence on teachers' job performance, and Adeyemi and Bolarinwa (2013), who found an association between principals' leadership styles and students' academic performance in Nigerian secondary schools.

Conclusion

Based on the findings of the study, it is concluded that principals in secondary schools in Plateau State adopt a combination of democratic, autocratic and delegative leadership behaviours in the administration of their schools. The use of different leadership approaches suggests that principals adjust their leadership practices according to the nature of the situation, the needs of teachers and the demands of school administration. However, democratic leadership appears particularly beneficial because it promotes teacher participation, communication, commitment and cooperation. The study also concludes that autocratic leadership has both positive and negative implications for secondary school performance. Firm direction, supervision and clear instructions from principals can help maintain discipline, punctuality and compliance with school regulations. However, excessive authoritarian control may reduce teachers' motivation, limit their professional autonomy and potentially affect students' academic performance negatively. Therefore, autocratic leadership is more appropriate when applied moderately and according to the circumstances confronting the school.

Recommendations

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

1. Principals should emphasize democratic leadership practices by involving teachers in decision-making, encouraging them to express their opinions and delegating appropriate responsibilities.
2. Principals should avoid excessive use of autocratic leadership. While firm direction, supervision and clear instructions are necessary for maintaining discipline and ensuring compliance with school rules, excessive control should be avoided because it can reduce teachers' motivation and negatively affect school performance.
3. The Ministry of Education and relevant educational authorities should organize regular leadership development programmes for principals. The programmes should equip principals with skills for effectively combining democratic, autocratic and delegative leadership approaches according to the needs and circumstances of their schools.



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