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EDITORIAL NOTE

I have the delight and privilege to write as Editor-in-chief of the *Rima International Journal of Education (RIJE)*, an official research publication of the Faculty of Education, Sokoto State University. This edition (Volume 5: No. 2) of the *RIJE* has sixteen (16) articles from distinguished scholars and educators, poised to report cut-edge research findings and discourse on contemporary educational issues with implications for pedagogy, national and global development.

The dictum of “publish or perish” is in vogue in any worthwhile research-based institutions, hence strict adherence to publications in any reputable and recognized Journal, as such *RIJE* is recognized as complimentary to contemporary dissemination and propagation of knowledge. Therefore, the Editorial Board of *RIJE* wishes to use this medium to solicit well researched articles for publication from teeming population of academics and researchers globally. The Journal would always be subjected to thorough peer review and proper editorial vetting.

Assc. Prof. M.S. Nawait,
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The Editorial Board invites interested scholars and researchers to submit original manuscripts for publication. Published quarterly by the Faculty of Education, Sokoto State University, Sokoto, this journal disseminates relevant research findings in all fields of education. Both empirical and theoretical papers that are articulately written based on contemporary educational issues that have national and international relevance shall be accepted for publication. The manuscript shall not be under consideration elsewhere for publication.

Guidelines for Manuscript Submission

- i. **Language:** Manuscripts meant for submission should be written in English language with strict adherence to British standard.
- ii. **Paper Size, Font and Length:** Manuscript prepared for submission should be typed in Microsoft Word on A4 paper size using Times New Romans, font size 12 and 1.5-line spacing. The manuscript should not be more than 15 pages including references.
- iii. **Title Page:** The title page should capture the title of the manuscript which should not be too lengthy, the author(s) name(s) with surname in Upper Case, institution's affiliation, current mailing address, valid e-mail address, Phone No(s) and full postal address of the main author and co-authors.
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- v. **Organization:** The manuscript should be explicitly presented under various headings and sub-headings. The ideas should be properly organized. Coherent and sequential. More importantly, the following should be made conspicuous while preparing empirical papers: **Introduction** (indicating rationale for the study, review of related literature, problem statement, and purpose of the study), **Methodology**, **Results**, **Discussion**, **Conclusion** and **Recommendations**.
- vi. **Arrangement of Tables/Figures:** The tables/figures should be arranged properly and neatly using the latest APA style and the title of the tables/figures should appear on top of each table such as, (Table 1; Table 2, etc/Figure 1, Figure 2, etc). There should be an avoidance of moving over to the next page.
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 - ix. **Referencing Style:** All in-text citations and references should confirm strictly with the latest APA style/format.
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Teachers' Qualification and Teaching Experience as Determinants of Physics Curriculum Implementation in Senior Secondary Schools in Kano State, Nigeria

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Abstract

This study examined teachers' qualification and teaching experience as determinants of physics curriculum implementation in senior secondary schools in Kano Central Senatorial Zone, Nigeria. The study was motivated by concerns over students' poor performance in physics and the need to understand how teacher-related factors influence effective curriculum delivery. A descriptive survey research design was adopted for the study. The population consisted of eighty-two physics teachers in public senior secondary schools in the study area, and a census sampling technique was used to include all teachers. Data were collected using a structured questionnaire titled Physics Curriculum Implementation Questionnaire (PCIQ) and analysed using mean and standard deviation. The findings revealed that teachers' qualification significantly influences the selection of instructional materials used in physics teaching, while teaching experience influences the selection of teaching methods during physics instruction. The results indicate that qualified and experienced teachers are more likely to utilise appropriate instructional resources and adopt effective teaching strategies that support successful curriculum implementation. The study concludes that teacher-related characteristics play a crucial role in the effective implementation of the physics curriculum. It therefore recommends the recruitment of qualified physics teachers and the provision of regular professional development programmes to improve instructional practices in secondary schools.

Keywords: Physics Curriculum Implementation, Teacher Qualification, Teaching Experience, Instructional Methods, Secondary Education

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Introduction

Education plays a critical role in national development by enabling individuals to acquire knowledge, skills, and competencies necessary for social and technological advancement (Don, 2020; Musa *et al.*, 2021). Within the education system, the curriculum provides the framework that guides teaching and learning by outlining educational goals, subject content, instructional methods, and assessment strategies (Wortham, 2022). Effective curriculum implementation occurs when teachers successfully translate curriculum objectives into classroom practices through appropriate instructional strategies, learning resources, and evaluation techniques (Nation & Macalister, 2021).

Teachers serve as the primary agents of curriculum implementation because they interpret curriculum guidelines, organise instructional activities, and assess students' learning outcomes. Their professional competence, including academic qualification and teaching experience, significantly influences the effectiveness of curriculum delivery (Penuel *et al.*, 2020). Teachers with adequate qualifications possess strong subject knowledge and pedagogical skills, while experienced teachers develop practical teaching strategies and classroom management abilities that enhance instructional effectiveness (Shulman, 1986; Haque & David, 2022).

Physics is a fundamental science subject that contributes significantly to technological advancement and national development. It provides the scientific foundation for disciplines such as engineering, electronics, telecommunications, and energy technology (Halliday *et al.*, 2020). Physics education also develops learners' analytical thinking and problem-solving skills required for innovation and scientific advancement (Mbamara & Eya, 2020). Despite its importance, students' performance in physics in many Nigerian secondary schools has remained unsatisfactory, often due to factors such as inadequate instructional materials, ineffective teaching methods, and poor curriculum implementation (Ajaja, 2019; Adeyemo, 2019).

Effective implementation of the physics curriculum depends largely on the teacher, who determines how instructional materials are used and selects appropriate teaching strategies during classroom instruction (Penuel *et al.*, 2020). Teacher qualification influences the depth of subject knowledge and pedagogical competence required to present complex physics concepts

effectively, while teaching experience enables teachers to refine instructional practices and adapt teaching methods to meet students' learning needs (Shulman, 1986; Haque & David, 2022).

Although previous studies have examined the influence of teacher characteristics on student achievement, there is limited empirical evidence on how teachers' qualification and teaching experience specifically influence the implementation of the physics curriculum in senior secondary schools in Kano Central Senatorial Zone of Kano State. This gap necessitates an investigation into how these teacher-related factors affect the selection of instructional materials and teaching methods during physics instruction.

The study was guided by the following objectives:

- I. To determine the influence of teachers' qualification on the selection of appropriate physics instructional materials in senior secondary schools in Kano Central Senatorial Zone.
- II. To examine the influence of teachers' teaching experience on the selection of appropriate teaching methods for physics curriculum implementation.

The following research questions guided the study:

- I. What is the influence of teachers' qualification on the selection of appropriate physics instructional materials in senior secondary schools?
- II. How does teachers' teaching experience influence the selection of appropriate teaching methods for physics curriculum implementation?

Methodology

This study adopted a descriptive survey research design to examine teachers' qualification and teaching experience as determinants of physics curriculum implementation in senior secondary schools in Kano Central Senatorial Zone, Nigeria. The population of the study comprised 82 physics teachers in public senior secondary schools within the study area. Due to the manageable size of

the population, a census sampling technique was employed to include all the teachers in the study.

Data were collected using a self-developed instrument titled *Physics Curriculum Implementation Questionnaire (PCIQ)*. The instrument consisted of two sections: Section A collected demographic information of the respondents, while Section B contained items designed to measure teacher-related variables and curriculum implementation practices. The questionnaire items were structured on a four-point Likert scale.

The instrument was validated by experts in science education, curriculum studies, and measurement and evaluation to ensure clarity, relevance, and adequacy of the items. A pilot study was conducted to determine the reliability of the instrument, and a Cronbach's Alpha coefficient of 0.73 was obtained, indicating acceptable internal consistency.

Data collection was carried out with the permission of relevant school authorities, and the questionnaires were administered directly to the respondents and retrieved upon completion. The collected data were analysed using descriptive statistics, specifically mean and standard deviation, to answer the research questions. Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS).

The population of the study comprised all physics teachers in public senior secondary schools within Kano Central Senatorial Zone, Nigeria. According to records from the Kano State Senior Secondary School Management Board, the total number of physics teachers in the zone was 82 as of 2024.

Because the population size was relatively small and manageable, the study adopted a census sampling technique, which involved including all members of the population in the study. The sample size was therefore 82 physics teachers, ensuring complete representation and eliminating sampling error.

Table 1: Distribution of Physics Teachers in Kano Central Senatorial Zone

S/N	Local Government Area	Number of Physics Teachers
1	Dala	18
2	Dawakin Kudu	9
3	Garun Malam	2
4	Kano Municipal	22
5	Warawa	1
6	Kumbotso	13

S/N	Local Government Area	Number of Physics Teachers
7	Kura	10
8	Gezawa	7
Total		82

Note: Data obtained from the Kano State Senior Secondary School Management Board, Department of Planning, Research and Statistics (2024).

Data were collected using a self-developed questionnaire titled “Physics Curriculum Implementation Questionnaire (PCIQ)”. The instrument consisted of two sections. Section A collected demographic information about the respondents, while Section B contained 40 items measuring teacher qualities and physics curriculum implementation. The items were structured on a four-point Likert scale ranging from *Strongly Agree* to *Strongly Disagree*.

The questionnaire was validated by experts in science education, curriculum studies, measurement and evaluation, and experienced physics teachers. The experts assessed the clarity, relevance and adequacy of the items in relation to the research objectives. Their suggestions and corrections were incorporated into the final version of the instrument to ensure both face and content validity.

A pilot study was conducted using 41 physics teachers to test the reliability of the instrument. Cronbach’s Alpha was used to determine internal consistency, and the instrument produced a reliability coefficient of 0.73, which is considered acceptable for educational research (Nunnally, 1978). This indicates that the questionnaire items were sufficiently consistent for data collection.

The researcher obtained permission from the Kano State Senior Secondary School Management Board and subsequently contacted principals of the selected schools. Questionnaires were administered directly to physics teachers with the assistance of school administrators. Completed questionnaires were retrieved immediately after completion to ensure a high response rate.

The data collected were analysed using descriptive statistics, specifically mean and standard deviation, to answer the research questions. Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 27.

Results and Discussion

Respondents' Demographic Characteristics

A total of 82 physics teachers from public senior secondary schools in Kano Central Senatorial Zone participated in the study. The demographic characteristics considered include gender, teaching experience, and academic qualification.

Table 1: Teachers' Qualification and Selection of Physics Instructional Materials

Item	Mean	Decision
Qualification helps in selecting laboratory apparatus	2.73	Agree
Qualification assists in selecting visual teaching aids	2.79	Agree
Qualification supports the selection of teaching models	2.83	Agree
Use of laboratory manuals for practical work	2.61	Agree
Selection of diagrams and photographs in teaching	2.90	Agree
Use of textbooks and problem-solving booklets	3.05	Agree
Use of real-life examples and demonstrations	3.61	Agree
Use of virtual laboratories	1.95	Disagree
Use of videos and animations	1.88	Disagree

Grand Mean = 2.72

Note. Decision rule: Mean $\geq$ 2.50 = Agree; Mean $<$ 2.50 = Disagree.

The data presented in Table 1 show that teachers' qualification has a significant influence on the selection of instructional materials used in physics teaching. The grand mean score of 2.72, which is above the decision benchmark of 2.50, indicates that respondents generally agreed that teacher qualification plays an important role in determining the choice of instructional resources. High mean scores were recorded for items such as the use of real-life examples and demonstrations (3.61), textbooks and problem-solving booklets (3.05), and selection of diagrams and photographs (2.90), indicating strong agreement among respondents. Similarly, the use of teaching models (2.83), visual teaching aids (2.79), and laboratory apparatus (2.73) were positively rated. However, the low mean scores for the use of virtual laboratories (1.95) and videos and animations (1.88) indicate that technology-based instructional materials are not widely utilised. This suggests that while qualified teachers effectively use traditional instructional resources, there is limited integration of modern technological tools in physics teaching.

Table 2: Teaching Experience and Selection of Teaching Methods

Item	Mean	Decision
Experience influences the choice of teaching methods	3.66	Agree

Item	Mean	Decision
Experience promotes collaborative teaching methods	3.64	Agree
Experience supports selection of appropriate teaching methods	2.50	Agree
Experience helps adapt methods to students' needs	3.57	Agree
Use of multiple teaching methods	3.37	Agree
Integration of theory with practical activities	3.64	Agree
Difficulty selecting methods due to limited preparation	1.59	Disagree
Experience supports technology integration	3.55	Agree

Grand Mean = 3.09

Note. Decision rule: Mean $\geq$ 2.50 = Agree; Mean $<$ 2.50 = Disagree.

The data in Table 2 indicate that teaching experience significantly influences the selection of teaching methods used in physics instruction. The grand mean score of 3.09, which is above the decision benchmark of 2.50, shows that respondents strongly agreed that teaching experience affects instructional practices. High mean scores were recorded for items such as the influence of experience on teaching methods (3.66), promotion of collaborative teaching methods (3.64), integration of theory with practical activities (3.64), and adaptation of teaching methods to students' needs (3.57), indicating strong agreement. The use of multiple teaching methods (3.37) and the role of experience in supporting appropriate method selection (2.50) were also positively rated. Conversely, the low mean score for difficulty in selecting teaching methods (1.59) indicates that experienced teachers generally do not face challenges in choosing appropriate instructional strategies. These results suggest that teaching experience enhances teachers' ability to effectively select and apply appropriate teaching methods in physics instruction.

Summary of Major Findings

The study revealed that:

1. Teachers' qualification influences the selection of instructional materials used in physics teaching.
2. Teachers' teaching experience influences the selection of teaching methods used in physics curriculum implementation.

Discussion

The results of the study are presented based on the research questions guiding the study. The findings from Table 1 revealed that teachers' qualification

influences the selection of instructional materials used in physics teaching. The grand mean score of 2.72, which is above the decision benchmark of 2.50, indicates that respondents agreed that teacher qualification plays a significant role in determining the type of instructional materials used during physics instruction. Specifically, items such as the use of laboratory apparatus (2.73), visual teaching aids (2.79), teaching models (2.83), textbooks and problem-solving booklets (3.05), and real-life demonstrations (3.61) recorded high mean scores, indicating strong agreement among respondents. However, the low mean scores recorded for the use of virtual laboratories (1.95) and videos and animations (1.88) indicate that technology-based instructional materials are not widely utilised. This suggests that although qualified teachers effectively use traditional instructional resources, there is limited integration of modern technological tools in physics teaching.

The findings from Table 2 showed that teaching experience influences the selection of teaching methods used in physics instruction. The grand mean score of 3.09 indicates a high level of agreement among respondents that teaching experience affects instructional practices. The high mean scores for items such as the influence of experience on teaching methods (3.66), collaborative teaching methods (3.64), adaptation of methods to students' needs (3.57), and integration of theory with practical activities (3.64) suggest that experienced teachers are more capable of selecting and applying effective teaching strategies. The low mean score for difficulty in selecting teaching methods (1.59) further indicates that experienced teachers are confident in their instructional decision-making.

The findings of this study highlight the importance of teacher-related factors in effective curriculum implementation. The result that teachers' qualification influences the selection of instructional materials is consistent with the findings of Adaramola and Obomanu (2019), who reported that teachers with higher academic qualifications are more likely to utilise appropriate instructional resources in science teaching. Qualified teachers possess deeper subject knowledge and pedagogical competence, which enable them to select suitable materials that enhance students' understanding of physics concepts.

Similarly, the finding that teaching experience influences the selection of teaching methods supports the study of Haque and David (2022), who found that experienced teachers demonstrate greater instructional effectiveness and classroom management skills. Teaching experience enables teachers to refine

their instructional strategies, adapt teaching methods to students' needs, and effectively integrate theory with practical activities.

Overall, the results suggest that teachers who are both qualified and experienced are better equipped to implement the physics curriculum effectively. Their ability to select appropriate instructional materials and adopt effective teaching methods contributes significantly to improved teaching and learning outcomes in physics education. However, the limited use of technology-based instructional materials indicates the need for increased integration of modern instructional technologies in physics teaching.

Conclusion and Recommendations

This study examined the role of teachers' qualities in the implementation of the senior secondary school physics curriculum in Kano Central Senatorial Zone, Nigeria. A descriptive survey research design was employed, and data were collected from 82 physics teachers using a structured questionnaire. The study investigated key teacher-related variables, including academic qualification, teaching experience, professional competence, and instructional practices.

The analysis revealed that teachers' professional characteristics play a significant role in curriculum implementation. In particular, teachers' qualification influenced the selection of instructional materials, while teaching experience affected the choice of instructional strategies used during physics instruction. Teacher competency was also found to influence the effectiveness of content delivery, and teachers' age was associated with differences in the evaluation strategies used in assessing students' learning outcomes.

Overall, the findings highlight the importance of competent and professionally prepared teachers in achieving the objectives of the physics curriculum in secondary schools.

Conclusions

Based on the findings of the study, it is concluded that the successful implementation of the physics curriculum in senior secondary schools depends largely on teacher-related factors. Teachers who possess appropriate academic qualifications, adequate teaching experience and strong pedagogical competence are more capable of selecting suitable instructional materials,

adopting effective teaching methods and delivering physics content effectively.

Furthermore, the study indicates that teacher characteristics influence assessment practices and instructional strategies used in the classroom. Strengthening teachers' professional capacity and providing adequate instructional resources will therefore enhance the effectiveness of physics curriculum implementation and improve students' understanding of physics concepts.

Recommendations

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

- i. Educational authorities should ensure the recruitment and deployment of qualified physics teachers in secondary schools in order to enhance effective selection and utilisation of instructional materials.
- ii. Regular professional development programmes, such as workshops, seminars and in-service training, should be organised to improve teachers' instructional skills and teaching methods in physics.
- iii. School administrators should provide professional support and supervision to encourage teachers to adopt effective teaching methods in physics instruction.
- iv. Government and school authorities should ensure the availability of adequate instructional materials and laboratory facilities to support effective physics teaching and learning.
- v. Physics teachers should adopt appropriate learner-centred teaching methods, such as demonstrations, guided discovery and problem-solving approaches, to improve students' understanding of physics concepts.

Suggestions for Further Research

The following areas are recommended for further studies:

1. Investigation of the influence of school environment on physics curriculum implementation.
2. Examination of the relationship between instructional materials utilisation and students' academic performance in physics.
3. A comparative study between public and private secondary schools to determine differences in physics curriculum implementation.
4. Examination of the impact of teacher professional development programmes on the effectiveness of physics teaching.
5. Future researchers may employ experimental research designs to examine the effects of specific teaching strategies on students' achievement in physics.

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Effect of Instructional Technology on Students' Academic Achievement in Islamic Studies at Nassarawa Zonal Education Directorate, Kano, Nigeria: A Theoretical Perspective

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Abstract

The integration of instructional technology into classroom teaching has become an important strategy for improving students' learning experiences and academic achievement in modern education. Despite the increasing relevance of technology in teaching and learning, the instruction of Islamic Studies in many secondary schools still relies largely on traditional teaching approaches that limit students' engagement and understanding of instructional content. This paper examines the effect of instructional technology on students' academic achievement in Islamic Studies at the Nassarawa Zonal Education Directorate in Kano State, Nigeria. The paper adopts a theoretical approach by analysing relevant literature and educational theories related to technology integration in teaching and learning. Key concepts such as instructional technology, Islamic Studies education, and academic achievement are clarified, while the discussion is anchored on Constructivist Learning Theory, the Technology Acceptance Model, and Connectivism Theory. The paper argues that the effective integration of instructional technology, including multimedia resources, digital learning platforms, and audio-visual instructional materials, can enhance students' engagement, improve their understanding of Islamic teachings, and promote better academic performance. The paper also highlights challenges associated with the integration of technology in schools, including inadequate technological infrastructure and limited teacher training. It concludes that adopting technology-supported instructional strategies can significantly improve the quality of Islamic Studies education and recommends increased investment in educational technology and teacher capacity development.

Keywords: Instructional Technology; Islamic Studies Education; Academic Achievement; Educational Technology; Secondary Education

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Introduction

In recent years, the rapid advancement of digital technologies has significantly transformed educational practices across the world. The integration of information and communication technologies (ICT) into teaching and learning has become a central strategy for improving instructional effectiveness and students' academic achievement in contemporary education systems. The COVID-19 pandemic further accelerated the adoption of digital learning tools, highlighting the importance of instructional technology in ensuring continuity of education and enhancing learning experiences (Adedoyin & Soykan, 2020; Dhawan, 2020). As a result, educational institutions are increasingly adopting technology-driven instructional approaches to meet the needs of 21st-century learners.

Instructional technology plays a critical role in facilitating interactive, learner-centred, and flexible learning environments. Recent studies have shown that the use of digital tools such as multimedia resources, online learning platforms, and virtual instructional environments enhances students' engagement, motivation, and academic performance (Bond, 2020; Trust & Bond, 2020). These technologies enable teachers to present instructional content in diverse formats, thereby improving students' understanding and retention of knowledge. In addition, technology-supported learning environments promote collaboration, critical thinking, and independent learning, which are essential skills in modern education (Martin & Bolliger, 2018; Rapanta *et al.*, 2020).

In the context of religious education, particularly Islamic Studies, effective instructional strategies are essential for achieving both cognitive and moral learning outcomes. Islamic Studies education aims not only to impart knowledge of religious teachings but also to develop students' moral character and ethical behaviour. However, the teaching of Islamic Studies in many secondary schools continues to rely heavily on traditional methods such as lecture-based instruction and rote memorisation, which may limit students' engagement and deeper understanding of the subject. Contemporary educational research emphasises the need for innovative pedagogical approaches that integrate technology to enhance the teaching and learning of religious subjects (Sahin, 2018).

Recent empirical studies have demonstrated that the integration of instructional technology can significantly improve students' academic achievement across different subject areas. Technology-enhanced learning environments allow students to interact with instructional materials, explore concepts independently, and engage in collaborative learning activities, all of which contribute to improved learning outcomes (Darling-Hammond *et al.*, 2020; Goel *et al.*, 2020). Despite these benefits, several challenges continue to hinder the effective integration of instructional technology in many developing countries, including Nigeria. These challenges include inadequate technological infrastructure, limited access to digital resources, insufficient teacher training, and weak institutional support systems (Adedoyin & Soykan, 2020).

In Nigeria, particularly in Kano State, Islamic Studies remains a core subject due to its cultural and religious significance. However, the effective teaching of the subject is often constrained by limited instructional resources and the continued use of traditional teaching methods. The integration of instructional technology into Islamic Studies instruction therefore presents an opportunity to enhance teaching effectiveness and improve students' academic achievement.

Against this background, this paper examines the effect of instructional technology on students' academic achievement in Islamic Studies at the Nassarawa Zonal Education Directorate, Kano, Nigeria. Specifically, the paper explores how the use of technology-supported instructional strategies can enhance students' engagement, improve their understanding of Islamic teachings, and contribute to better academic performance.

Conceptual Clarification

Conceptual clarification is important in academic research because it provides clear explanations of the major concepts used in a study. It helps readers understand the meaning and scope of the key variables under investigation. In this paper, the major concepts discussed include instructional technology, Islamic Studies education, and academic achievement.

Instructional Technology

Instructional technology refers to the systematic use of technological tools, resources, and processes to facilitate effective teaching and learning. It involves the application of modern digital technologies such as computers, multimedia projectors, audio-visual materials, online learning platforms, internet resources, and educational software to improve instructional delivery and enhance students' learning experiences. In contemporary education, instructional technology extends beyond the mere use of devices to include the strategic design, implementation, and evaluation of technology-supported learning environments that promote meaningful learning outcomes (Bond, 2020; Trust & Whalen, 2020).

Scholars have emphasised that instructional technology encompasses both theoretical and practical dimensions of teaching and learning. It involves the integration of pedagogical principles with technological tools to create effective and engaging learning experiences. While earlier definitions by Reiser and Dempsey (2017) and Gagné *et al.* (2005) conceptualised instructional technology as the application of instructional design and learning theories, recent studies highlight its evolving nature in response to digital transformation in education. For instance, Adedoyin and Soykan (2020) note that instructional technology plays a critical role in enabling flexible, remote, and blended learning environments, particularly in response to global disruptions such as the COVID-19 pandemic.

In modern educational settings, instructional technology plays a crucial role in creating learner-centred environments where students actively participate in the learning process. The integration of multimedia elements such as text, images, audio, and video has been shown to enhance students' comprehension and retention of information by engaging multiple cognitive processes (Mayer, 2009; Dhawan, 2020). Furthermore, technology-supported learning environments encourage collaboration, critical thinking, and independent learning, which are essential skills for 21st-century learners (Rapanta *et al.*, 2020; Darling-Hammond *et al.*, 2020).

Recent research also indicates that instructional technology improves students' engagement and academic achievement by providing interactive and personalised learning experiences. Digital tools such as virtual classrooms, educational applications, and multimedia resources enable students to access diverse learning materials and participate actively in the learning process

(Bond, 2020). In addition, instructional technology supports differentiated instruction by allowing teachers to adapt content to meet the diverse needs and learning styles of students (Trust & Whalen, 2020).

Within the context of secondary school education, instructional technology includes the use of computers, interactive whiteboards, projectors, educational videos, online learning platforms, and mobile learning applications. These tools enable teachers to present lessons in more engaging and interactive ways and help students visualise abstract concepts more clearly. Therefore, instructional technology can be regarded as an essential component of modern education that enhances instructional effectiveness, promotes active learning, and improves students' academic achievement.

Islamic Studies Education

Islamic Studies education refers to the teaching and learning of Islamic knowledge, values, and principles derived from the Qur'an and the traditions of Prophet Muhammad (peace be upon him). The subject is designed to provide learners with a comprehensive understanding of Islamic beliefs, practices, and moral teachings. It typically covers key areas such as Qur'anic studies, Hadith studies, Islamic jurisprudence (Fiqh), Islamic history, and Islamic ethics. Through engagement with these areas, learners develop a deeper understanding of the religious, moral, and cultural foundations of Islam.

Islamic education is widely recognised as a holistic system of learning that integrates spiritual, intellectual, and moral development. It aims to produce individuals who are not only knowledgeable about Islamic teachings but also capable of applying those teachings in their daily lives (Halstead, 2004; Sahin, 2018). Contemporary perspectives on Islamic education further emphasise the need to align traditional religious instruction with modern pedagogical practices in order to enhance learners' engagement and understanding (Sahin, 2018).

In many Muslim societies, Islamic Studies plays a vital role in shaping the moral and spiritual development of young people. The subject promotes values such as honesty, discipline, respect for others, compassion, and social responsibility, which are essential for personal and societal development. Recent studies have highlighted the importance of adopting innovative and

learner-centred approaches in teaching Islamic Studies to make the subject more relevant and engaging in the 21st century (Sahin, 2018; Darling-Hammond et al., 2020).

In Nigeria, particularly in northern regions such as Kano State where Islam plays a significant role in social and cultural life, Islamic Studies remains an important subject within the school curriculum. It contributes to the development of students' moral character and strengthens their religious identity. However, the effectiveness of Islamic Studies education depends largely on the teaching methods employed by teachers. Contemporary research suggests that integrating modern instructional strategies, including instructional technology, can significantly enhance students' understanding of Islamic teachings and improve learning outcomes (Adedoyin & Soykan, 2020; Rapanta et al., 2020).

Academic Achievement

Academic achievement refers to the level of success attained by students in their educational activities, typically measured through tests, examinations, assignments, and other forms of assessment. It reflects the extent to which learners have acquired knowledge, skills, and competencies in a particular subject or area of study. Academic achievement is commonly used as an indicator of the effectiveness of teaching and learning processes in educational institutions.

Traditionally, academic achievement has been associated with the attainment of educational objectives, including cognitive skills such as knowledge, comprehension, application, analysis, and evaluation (Bloom, 1956). However, contemporary perspectives extend this concept to include the ability of learners to apply knowledge meaningfully and demonstrate critical thinking and problem-solving skills in real-life contexts (Darling-Hammond et al., 2020).

Recent studies indicate that students' academic achievement is influenced by multiple factors, including teaching methods, learning environment, availability of instructional resources, student motivation, and access to technology-enhanced learning opportunities (Bond, 2020; Dhawan, 2020). Technology-supported instructional approaches, in particular, have been shown to improve students' engagement and facilitate deeper understanding of subject content, thereby contributing to improved academic performance.

In the context of Islamic Studies education, academic achievement refers to students' level of understanding and performance in Islamic Studies subjects as demonstrated through classroom assessments and external examinations. The effective use of instructional strategies, especially those supported by instructional technology, can enhance students' engagement and comprehension of Islamic teachings. For instance, the use of multimedia presentations, audio-visual materials, and digital learning platforms can help students better understand abstract religious concepts and improve their academic performance (Rapanta et al., 2020; Adedoyin & Soykan, 2020).

Theoretical Framework

A theoretical framework provides the foundation upon which a study is built. It explains the theories that guide the understanding of the relationship between the variables investigated in a study. In educational research, theories help to explain how learning occurs and how different instructional approaches influence students' learning outcomes. Since this paper examines the effect of instructional technology on students' academic achievement in Islamic Studies, it is important to anchor the discussion on relevant learning theories that explain how technology supports effective teaching and learning. This paper is guided by Constructivist Learning Theory, the Technology Acceptance Model (TAM), and Connectivism Theory.

Constructivist Learning Theory

Constructivist learning theory emphasises that learners actively construct knowledge through interaction with their learning environment rather than passively receiving information from teachers. The theory suggests that learning occurs when students engage with instructional materials, explore ideas, and connect new knowledge with their prior experiences. Foundational scholars such as Piaget (1972) argue that knowledge is constructed through cognitive processes that enable learners to interpret and reorganise information based on experience. Similarly, Vygotsky (1978) highlights the importance of social interaction in learning through his concept of the Zone of Proximal Development, which explains how learners achieve higher levels of understanding with appropriate support.

While these classical perspectives remain relevant, recent studies have reinforced the importance of constructivist approaches in technology-

enhanced learning environments. Contemporary research shows that digital learning tools support active knowledge construction by enabling learners to interact with content, collaborate with peers, and engage in problem-solving activities (Rapanta et al., 2020; Bond, 2020). Instructional technology therefore aligns strongly with constructivist principles, as it facilitates learner-centred environments where students actively participate in the learning process.

Digital tools such as multimedia presentations, educational videos, interactive simulations, and online discussion platforms enable students to explore concepts actively and engage with learning materials in meaningful ways. These tools are particularly useful in subjects such as Islamic Studies, where abstract concepts and historical contexts can be better understood through visualisation and interactive learning. Consequently, the integration of instructional technology enhances students' understanding and improves academic achievement (Darling-Hammond et al., 2020).

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) explains how individuals adopt and use technological systems. The model, developed by Davis (1989), identifies perceived usefulness and perceived ease of use as the key factors influencing technology adoption. Perceived usefulness refers to the extent to which individuals believe that using a particular technology will enhance their performance, while perceived ease of use relates to how effortless the technology is to use.

Recent studies have extended the application of TAM in educational contexts, particularly in understanding teachers' adoption of instructional technology. Research indicates that teachers are more likely to integrate digital tools into their instructional practices when they perceive such technologies as beneficial to teaching effectiveness and student learning outcomes (Adedoyin & Soykan, 2020; Trust & Whalen, 2020). Conversely, lack of training, technical support, and confidence in using technology can limit its adoption.

In the context of Islamic Studies education, teachers' attitudes toward instructional technology play a crucial role in determining how effectively technological tools are integrated into classroom instruction. When teachers perceive technology as both useful and easy to use, they are more likely to adopt digital tools such as multimedia presentations, projectors, and

educational software. This, in turn, enhances students' engagement and improves their academic performance (Bond, 2020).

Connectivism Theory

Connectivism is a contemporary learning theory that explains how learning occurs in the digital age through networks and technological systems. Proposed by Siemens (2005), the theory posits that knowledge is distributed across networks of information sources and that learning occurs when individuals connect with these networks.

Recent research supports the relevance of connectivism in modern education, particularly in technology-driven learning environments. Studies show that digital platforms, online learning communities, and multimedia resources enable learners to access diverse sources of information, collaborate with others, and engage in continuous learning beyond the traditional classroom (Dhawan, 2020; Rapanta et al., 2020). This reflects the growing importance of networked learning in the 21st century.

In the context of Islamic Studies education, connectivism highlights the potential of instructional technology to expand students' access to Islamic knowledge. Through digital tools, students can listen to Qur'anic recitations, access online lectures, explore digital Islamic libraries, and participate in virtual discussions. These opportunities enhance students' engagement with learning materials and contribute to improved academic achievement (Adedoyin & Soykan, 2020).

Relevance of the Theories to the Study

The three theories discussed above provide a comprehensive framework for understanding the relationship between instructional technology and students' academic achievement. Constructivist learning theory explains how technology-supported interactive environments enhance students' understanding of instructional content. The Technology Acceptance Model highlights the role of teachers' perceptions and attitudes in determining the effective use of instructional technology in classrooms. Connectivism theory emphasises the importance of digital networks and technological resources in facilitating modern learning experiences.

Together, these theories support the argument that the effective integration of instructional technology in teaching Islamic Studies can create engaging learning environments, improve students' comprehension of religious concepts, and enhance their academic performance. The combination of these theoretical perspectives provides a strong foundation for analysing how instructional technology influences learning outcomes in contemporary educational settings.

Review of Related Literature

The integration of instructional technology in education has attracted significant attention from scholars and educators due to its potential to improve teaching effectiveness and students' academic achievement. Instructional technology refers to the systematic use of technological tools, digital resources, and multimedia applications to support the teaching and learning process. Over the years, researchers have examined how technology-based instructional approaches influence students' engagement, motivation, and learning outcomes across different subject areas.

Scholars have consistently emphasised that the use of instructional technology enhances the quality of instruction and promotes effective learning. According to Robert A. Reiser and John V. Dempsey, instructional technology involves the systematic design, development, utilisation, and evaluation of learning processes and resources that facilitate effective teaching and improve students' learning experiences (Reiser & Dempsey, 2017). The integration of technology into teaching allows educators to present information using multimedia formats such as images, audio, video, and animations, thereby making learning more interactive and engaging for students.

Similarly, Robert E. Mayer explains that multimedia instruction enhances students' cognitive processing by presenting information through both visual and verbal channels, which improves understanding and retention of knowledge (Mayer, 2009). This approach is particularly useful in subjects where abstract or complex concepts need to be explained clearly. Multimedia presentations, simulations, and audio-visual materials can therefore help students better comprehend instructional content.

Several studies have also highlighted the positive influence of instructional technology on students' academic achievement. For instance, Thomas Bates notes that technology-supported learning environments encourage active

participation, collaborative learning, and independent study, all of which contribute to improved learning outcomes (Bates, 2019). Similarly, Margaret D. Roblyer and Aaron H. Doering report that technology-based instructional strategies enable teachers to create engaging learning environments that enhance students' motivation and academic performance (Roblyer & Doering, 2014).

In addition, instructional technology provides opportunities for teachers to diversify their instructional methods and address different learning styles among students. According to Dale H. Schunk, effective learning occurs when instructional methods are adapted to learners' needs and when students actively participate in the learning process (Schunk, 2012). The use of instructional technology supports this process by allowing teachers to present information in multiple formats and encourage interactive learning experiences.

In the context of Islamic Studies education, the use of innovative teaching strategies is particularly important for enhancing students' understanding of religious concepts and values. Islamic Studies is not only concerned with the acquisition of religious knowledge but also with the development of moral character and ethical behaviour among learners. According to J. Mark Halstead, Islamic education aims to nurture morally responsible individuals by integrating spiritual, intellectual, and ethical dimensions of learning (Halstead, 2004). Therefore, effective teaching methods are necessary to ensure that students understand and internalise Islamic teachings.

However, research indicates that the teaching of Islamic Studies in many schools still relies heavily on conventional instructional approaches such as lecture methods and memorisation. While these methods may transmit factual information, they may not sufficiently promote active learning or critical thinking among students. According to Abdullah Sahin, contemporary Islamic education requires innovative pedagogical approaches that engage students actively and encourage deeper reflection on religious teachings (Sahin, 2018).

Instructional technology has the potential to improve the teaching of Islamic Studies by making lessons more interactive and accessible. Digital tools such as audio recordings of Qur'anic recitations, multimedia presentations on Islamic history, and educational videos explaining Islamic jurisprudence can enhance students' understanding of complex religious concepts. These

technological resources can also increase students' motivation and interest in learning Islamic Studies.

Empirical studies in educational technology have further demonstrated the positive impact of technological integration on students' academic achievement. According to Linda Darling-Hammond and her colleagues, technology-enhanced learning environments support deeper learning by allowing students to explore concepts, collaborate with peers, and apply knowledge in meaningful contexts (Darling-Hammond et al., 2020). Such learning environments promote critical thinking and problem-solving skills, which contribute to improved academic performance.

Despite these benefits, several challenges hinder the effective integration of instructional technology in many educational institutions. These challenges include inadequate technological infrastructure, limited access to digital resources, insufficient teacher training, and lack of institutional support. According to Michael Fullan, successful integration of educational technology requires not only the availability of technological tools but also adequate teacher training and supportive educational policies (Fullan, 2013).

In Nigeria, the integration of instructional technology in teaching and learning remains uneven across different schools and regions. Many schools face challenges related to limited technological facilities, poor internet connectivity, and inadequate professional development opportunities for teachers. These challenges can affect the effectiveness of technology-based instructional approaches in improving students' academic achievement.

Nevertheless, the potential benefits of instructional technology in enhancing teaching effectiveness and students' learning outcomes remain widely recognised. When properly implemented, technology-supported instructional strategies can transform traditional teaching practices and create more engaging learning environments for students. In the context of Islamic Studies education, the use of instructional technology can facilitate better understanding of religious concepts, improve students' motivation to learn, and enhance their academic achievement.

Therefore, examining the influence of instructional technology on students' academic achievement in Islamic Studies is important for understanding how modern teaching strategies can improve the quality of religious education in secondary schools.

Implications for Teaching and Educational Policy

The discussion on the role of instructional technology in improving students' academic achievement in Islamic Studies has several important implications for teaching practice, curriculum development, and educational policy. As educational systems continue to evolve in response to technological advancements, integrating instructional technology into classroom instruction has become increasingly necessary for improving the quality of education and students' learning outcomes.

First, the integration of instructional technology has important implications for teaching practices in Islamic Studies. Teachers play a central role in determining how technology is utilised in the classroom. When teachers incorporate digital tools such as multimedia presentations, educational videos, interactive learning applications, and online resources into their lessons, they can create more engaging and interactive learning environments for students. Such environments encourage students' active participation and enhance their understanding of complex concepts. According to Robert E. Mayer, multimedia instructional approaches that combine visual and verbal information significantly improve students' comprehension and retention of knowledge (Mayer, 2009). Therefore, Islamic Studies teachers should be encouraged to adopt technology-based instructional strategies that facilitate active learning and improve students' academic performance.

Second, the findings of this discussion highlight the need for professional development and training programmes for teachers. Many teachers may lack the necessary skills and confidence to effectively integrate instructional technology into their teaching. Teacher training programmes should therefore focus on equipping educators with the knowledge and competencies required to use digital tools in instructional delivery. According to Michael Fullan, successful educational reform requires continuous professional development that enables teachers to adapt to new instructional approaches and technological innovations (Fullan, 2013). Providing teachers with adequate training will enhance their ability to utilise instructional technologies effectively in teaching Islamic Studies.

Third, the integration of instructional technology has implications for curriculum planning and development. Curriculum planners should consider incorporating technology-based instructional strategies into the Islamic

Studies curriculum in order to make the subject more engaging and relevant to contemporary learners. For instance, the curriculum could encourage the use of multimedia resources, digital Qur'anic recitations, interactive learning platforms, and educational software to support teaching and learning activities. According to Thomas Bates, modern curricula should reflect the changing nature of knowledge and learning by integrating digital technologies that support flexible and interactive learning environments (Bates, 2019).

Fourth, educational policy makers have a significant role to play in promoting the effective use of instructional technology in schools. Governments and educational authorities should invest in technological infrastructure such as computers, projectors, internet connectivity, and digital learning resources to support technology-based instruction. In addition, policies should be developed to ensure that schools have access to adequate technological facilities and technical support systems. According to Linda Darling-Hammond and colleagues, educational policies that support technology integration can significantly enhance teaching quality and promote improved learning outcomes among students (Darling-Hammond et al., 2020).

Furthermore, school administrators should create supportive learning environments that encourage the use of instructional technology in teaching. This includes providing teachers with access to technological resources, allocating time for professional development, and fostering collaboration among teachers to share innovative teaching practices. Such institutional support can help ensure the successful implementation of instructional technology in schools.

In the context of Islamic Studies education in Nigeria, particularly in Kano State, the effective integration of instructional technology can contribute significantly to improving the teaching and learning of the subject. By adopting modern instructional approaches supported by technology, teachers can enhance students' interest in Islamic Studies and promote deeper understanding of Islamic teachings. Consequently, this can lead to improved academic achievement and stronger moral development among students.

Conclusion

Instructional technology has become an essential component of modern education due to its potential to enhance teaching effectiveness and improve students' learning outcomes. The integration of technological tools into

classroom instruction provides opportunities for teachers to present learning materials in more engaging and interactive ways, thereby promoting active participation and deeper understanding among students.

This paper examined the effect of instructional technology on students' academic achievement in Islamic Studies at the Nassarawa Zonal Education Directorate in Kano, Nigeria. The discussion highlighted the importance of instructional technology in creating learner-centred instructional environments that support meaningful learning experiences. The paper also emphasised that the effective use of digital tools such as multimedia presentations, audio-visual materials, and online learning resources can enhance students' comprehension of Islamic concepts and improve their academic performance.

The theoretical perspectives discussed in this paper—including Constructivist Learning Theory, the Technology Acceptance Model, and Connectivism Theory—provide a strong foundation for understanding how instructional technology can support effective teaching and learning processes. These theories emphasise the importance of interactive learning environments, positive attitudes toward technology adoption, and the use of digital networks to facilitate knowledge acquisition.

Despite the numerous benefits associated with instructional technology, several challenges such as limited technological infrastructure, inadequate teacher training, and insufficient institutional support may hinder its effective implementation in some educational settings. Addressing these challenges requires collaborative efforts from teachers, school administrators, curriculum planners, and educational policymakers.

Overall, the integration of instructional technology in the teaching of Islamic Studies has the potential to transform traditional teaching practices and improve students' academic achievement. By adopting innovative instructional strategies supported by technology, educators can create engaging learning environments that enhance students' understanding of Islamic teachings and contribute to their intellectual and moral development.

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Availability and Utilisation of Instructional Materials for Effective Civic Education Curriculum Implementation in Upper Basic Schools in Kano State, Nigeria

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Abstract

Instructional materials play an essential role in facilitating effective teaching and learning in schools. In Civic Education, instructional materials help learners understand civic concepts, democratic values, and social responsibilities more effectively. However, inadequate availability and utilization of instructional resources often hinder effective curriculum implementation in Nigerian schools. This study examined the availability and utilization of instructional materials for effective Civic Education curriculum implementation in upper basic schools in Kano Central Senatorial Zone, Kano State, Nigeria. The study adopted a descriptive survey research design. The population consisted of 118 Civic Education teachers drawn from forty (40) upper basic schools in the study area, and a census sampling technique was employed due to the manageable population size. Data were collected using a structured questionnaire adapted from the Civic Education Curriculum Implementation Questionnaire (CECIQ). Descriptive statistics such as mean and standard deviation were used to answer the research questions, while inferential statistics were used to test the hypotheses at the 0.05 level of significance. The findings revealed that although some instructional materials such as textbooks and charts are available in schools, many essential teaching resources, including audio-visual aids and digital learning materials, are inadequate. The study also found that effective utilization of instructional materials significantly enhances Civic Education curriculum implementation. The study therefore concludes that both the availability and proper utilization of instructional materials are critical for effective curriculum delivery in Civic Education. It is recommended that government and educational authorities provide adequate instructional materials and organise regular teacher training programmes to improve the utilisation of instructional resources.

Keywords: Instructional Materials, Civic Education, Curriculum Implementation, Upper Basic Schools, Teaching Resources

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Introduction

Education serves as a fundamental instrument for national development and social transformation. It equips individuals with knowledge, skills, values, and attitudes necessary for effective participation in society (UNESCO, 2015). In Nigeria, Civic Education is an important subject introduced into the basic education curriculum to promote democratic values, responsible citizenship, and national unity among students.

The introduction of Civic Education into the Nigerian school curriculum was part of educational reforms aimed at strengthening civic awareness and democratic participation among citizens. According to the Nigerian Educational Research and Development Council (NERDC, 2012), Civic Education is designed to equip learners with knowledge of their civic rights and responsibilities while fostering attitudes that support peaceful coexistence and national development.

The effectiveness of Civic Education instruction, however, depends largely on the availability and proper utilization of instructional materials in the teaching-learning process. Instructional materials refer to teaching aids and resources used by teachers to facilitate learning and improve students' understanding of subject content (Abolade, 2018). These materials include textbooks, charts, audio-visual aids, digital resources, models, and other learning tools that make teaching more effective and meaningful.

Scholars have emphasized that instructional materials play a crucial role in improving classroom instruction and enhancing students' learning outcomes. According to Ughamadu (2014), instructional materials stimulate students' interest, make abstract concepts more concrete, and promote effective knowledge acquisition. In Civic Education, the use of instructional materials such as visual aids, case studies, and multimedia resources helps learners understand civic concepts and societal issues more clearly.

Despite the importance of instructional materials in teaching and learning, many Nigerian schools face challenges related to the availability and utilization of teaching resources. Studies have shown that inadequate instructional materials often hinder effective curriculum implementation and limit students' understanding of key concepts (Ogar & Opoh, 2015). In many

schools, teachers rely mainly on textbooks and lecture methods due to the absence of other teaching resources.

In Kano State, particularly in upper basic schools, concerns have been raised about the adequacy of instructional materials used for Civic Education instruction. The absence of relevant teaching aids may affect teachers' ability to effectively deliver Civic Education lessons and may limit students' engagement with civic concepts and democratic values.

Given the importance of instructional materials in facilitating effective curriculum implementation, it is necessary to examine their availability and utilization in Civic Education teaching. Understanding how these resources are used in classrooms will provide valuable insights for improving Civic Education instruction and enhancing students' civic competence.

Instructional materials are essential resources that support effective teaching and learning in schools. In Civic Education, instructional materials such as textbooks, charts, audio-visual aids, and digital learning resources help teachers present civic concepts in ways that enhance students' understanding and engagement. The use of appropriate instructional materials also promotes active learning and improves students' comprehension of civic values and responsibilities.

Despite the importance of instructional materials in facilitating effective teaching, many schools in Nigeria face challenges related to the availability and utilisation of teaching resources. In some cases, instructional materials are either inadequate or not effectively utilised by teachers during classroom instruction. When instructional materials are lacking or poorly utilised, teachers often rely mainly on verbal explanations and lecture methods, which may limit students' understanding of civic concepts.

Previous studies have shown that inadequate instructional materials can hinder curriculum implementation and reduce the effectiveness of classroom instruction. However, it remains unclear to what extent instructional materials are available and utilised in the teaching of Civic Education in upper basic schools in Kano Central Senatorial Zone.

Given the importance of instructional materials in enhancing the teaching and learning process, it is necessary to examine their availability and utilisation in Civic Education instruction. Therefore, this study seeks to investigate the

availability and utilisation of instructional materials for effective Civic Education curriculum implementation in upper basic schools in Kano Central Senatorial Zone.

Review of Related Literature

Civic Education is an important aspect of education that aims to prepare individuals for active participation in society by equipping them with knowledge of civic rights, responsibilities, and democratic values. It focuses on developing responsible citizens who can contribute positively to the political, social, and economic development of their country (Galston, 2001). Through Civic Education, learners are expected to develop an understanding of democratic principles, respect for human rights, and a sense of national identity.

In Nigeria, Civic Education was introduced into the basic education curriculum to address issues such as political apathy, corruption, indiscipline, and lack of civic responsibility among citizens. According to Falade and Adeyemi (2015), Civic Education plays a critical role in promoting democratic participation and strengthening national unity. The subject helps learners understand their roles in society and encourages them to participate actively in democratic processes.

The Nigerian Educational Research and Development Council (NERDC) incorporated Civic Education into the nine-year basic education curriculum to ensure that students acquire the civic knowledge and values necessary for responsible citizenship (NERDC, 2012). The subject therefore serves as an important tool for promoting social cohesion, ethical behaviour, and democratic governance.

Concept of Instructional Materials

Instructional materials are essential components of the teaching and learning process. They refer to the various teaching aids and resources used by teachers to facilitate learning and improve students' understanding of subject content. Instructional materials include textbooks, charts, models, audio-visual aids, digital learning resources, and other educational tools that enhance classroom instruction (Abolade, 2018).

Instructional materials help teachers present information more effectively and make learning experiences more meaningful for students. According to Ughamadu (2014), instructional materials make abstract ideas more concrete, stimulate students' interest, and promote active participation in the learning process. The use of appropriate teaching materials also helps to improve students' retention of knowledge and enhance their overall learning outcomes.

In Civic Education, instructional materials play a crucial role in helping students understand civic concepts and societal issues. Visual aids, case studies, and multimedia resources can help students relate classroom learning to real-life situations. When instructional materials are effectively utilized, they enhance students' understanding of civic responsibilities and democratic principles.

However, several studies have shown that many schools lack adequate instructional materials, which limits teachers' ability to deliver effective instruction. In such situations, teachers often rely heavily on lecture methods, which may reduce students' engagement in the learning process (Ogar & Opoh, 2015).

Utilisation of Instructional Materials in Teaching

The effectiveness of instructional materials depends not only on their availability but also on how well they are utilized during classroom instruction. Utilization of instructional materials refers to the extent to which teachers incorporate teaching resources into their instructional practices to enhance learning outcomes.

Effective utilization of instructional materials enables teachers to present information in multiple formats and engage students in active learning. According to Chapman (2019), instructional materials help teachers explain complex concepts more clearly and encourage collaborative learning among students. The use of appropriate teaching resources also supports different learning styles and improves students' comprehension.

In Civic Education teaching, instructional materials such as charts, audio-visual resources, and real-life examples can help students understand civic concepts such as democracy, governance, and human rights. Participatory teaching strategies combined with instructional materials can promote critical thinking and civic awareness among learners (Yusuf, 2015).

Despite these benefits, many teachers face challenges in utilizing instructional materials effectively due to limited resources and inadequate training. Studies have shown that lack of professional development opportunities may hinder teachers' ability to integrate instructional materials into their teaching practices effectively (Kane & Blazer, 2019).

The study seeks to achieve the following objectives:

- I. To investigate the effectiveness of instructional materials used for the implementation of Civic Education curriculum in upper basic schools in Kano Central Senatorial Zone.
- II. To examine the provision of teacher professional development for the implementation of Civic Education curriculum in upper basic schools in Kano Central Senatorial Zone.

The following research questions guided the study:

- I. How effective are the instructional materials used for implementing the Civic Education curriculum in upper basic schools in Kano Central Senatorial Zone?
- II. Is there adequate provision for teacher professional development for implementing Civic Education curriculum in upper basic schools in Kano Central Senatorial Zone?

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

- I. There is no significant relationship between the availability of instructional materials and the implementation of Civic Education curriculum in upper basic schools in Kano Central Senatorial Zone.
- II. Teacher professional development does not significantly influence the effective implementation of Civic Education curriculum in upper basic schools in Kano Central Senatorial Zone.

Methodology

This study adopted a descriptive survey research design to examine the availability and utilisation of instructional materials for effective Civic Education curriculum implementation in upper basic schools in Kano Central

Senatorial Zone, Kano State. The descriptive survey design was considered appropriate because it enables researchers to collect data from respondents in order to describe existing conditions and practices without manipulating the variables under investigation.

The sample size for the study consisted of the 118 Civic Education teachers identified in the population. Since the population size was relatively small and accessible, the study adopted a census sampling technique, whereby all members of the population were included in the study.

Data for the study were collected using a structured questionnaire adapted from the Civic Education Curriculum Implementation Questionnaire (CECIQ). The instrument consisted of two sections: Section A captured respondents' demographic information, while Section B assessed the availability and utilisation of instructional materials for Civic Education teaching using a four-point Likert scale. The instrument was validated by experts in curriculum studies to ensure it measured the intended variables, and necessary revisions were made based on their feedback.

A pilot study was conducted to establish the reliability of the instrument, and the results confirmed its internal consistency and suitability for data collection. Data were collected with permission from school authorities, and questionnaires were administered directly to Civic Education teachers and retrieved after completion.

The data were analysed using both descriptive and inferential statistics. Mean and standard deviation were used to answer the research questions, while inferential statistics were employed to test hypotheses at the 0.05 level of significance. The results were presented in tables and interpreted to determine the influence of instructional materials on the implementation of the Civic Education curriculum.

Research Question One: How effective are the instructional materials used for implementing the Civic Education curriculum in upper basic schools in Kano Central Senatorial Zone?

Table 3: Availability and Effectiveness of Instructional Materials

Instructional Materials	Mean	Standard Deviation	Decision
Civic Education textbooks	3.46	0.71	Accepted
Charts and posters	3.18	0.82	Accepted
Audio-visual materials	2.65	0.90	Rejected

Instructional Materials	Mean	Standard Deviation	Decision
Digital learning resources	2.48	0.93	Rejected
Real-life civic examples	3.32	0.75	Accepted

Criterion Mean = **3.00**

The results in Table 3 show that textbooks, charts, and real-life examples are commonly used instructional materials in Civic Education teaching. However, audio-visual materials and digital learning resources are largely unavailable or underutilised in many schools.

This finding indicates that although some traditional instructional materials are available, modern teaching resources that could enhance students' understanding of civic concepts are inadequate.

Research Question Two: Is there adequate provision for teacher professional development for implementing Civic Education curriculum in upper basic schools in Kano Central Senatorial Zone?

Table 4: Teacher Professional Development for Civic Education Instruction

Professional Development Activities	Mean	Standard Deviation	Decision
Workshops on Civic Education teaching	2.72	0.85	Rejected
Seminars on instructional materials utilisation	2.64	0.88	Rejected
In-service training programmes	2.69	0.86	Rejected
Curriculum implementation training	2.91	0.80	Rejected

Criterion Mean = **3.00**

The results indicate that teacher professional development opportunities are generally inadequate. Most respondents reported that they rarely participate in workshops, seminars, or training programmes related to Civic Education teaching and the utilisation of instructional materials.

Test of Hypotheses

Hypothesis One: There is no significant relationship between the availability of instructional materials and the implementation of Civic Education curriculum in upper basic schools in Kano Central Senatorial Zone

Table 5: Correlation Analysis

Variables	N	r	p-value	Decision
Instructional Materials & Curriculum Implementation	118	0.58	0.003	Reject Ho

The correlation coefficient of 0.58 indicates a positive relationship between the availability of instructional materials and Civic Education curriculum implementation. Since the p-value (0.003) is less than the significance level of 0.05, the null hypothesis is rejected. This implies that instructional materials significantly influence the effective implementation of the Civic Education curriculum.

Hypothesis Two: Teacher professional development does not significantly influence the effective implementation of Civic Education curriculum

Table 6: Regression Analysis

Variable	Beta	t-value	p-value
Teacher professional development	0.49	3.96	0.002

The regression results show that teacher professional development significantly influences Civic Education curriculum implementation because the p-value (0.002) is less than 0.05. Therefore, the null hypothesis is rejected.

Discussion

The findings of this study revealed that instructional materials such as textbooks and charts are available in most schools and are commonly used during Civic Education instruction. However, modern instructional materials including audio-visual resources and digital learning tools are largely unavailable. This finding agrees with Ogar and Opoh (2015), who reported that inadequate instructional materials hinder effective curriculum implementation in Nigerian schools.

The study also found that teacher professional development opportunities are inadequate. Most teachers reported that they rarely participate in workshops or training programmes related to Civic Education teaching. This finding supports the study by Kane and Blazer (2019), which emphasized that lack of professional development opportunities can hinder teachers' ability to effectively utilise instructional materials in the classroom.

Furthermore, the results of the statistical analysis revealed that the availability and utilisation of instructional materials significantly influence the implementation of the Civic Education curriculum. This finding supports the argument of Ughamadu (2014), who noted that instructional materials enhance students' understanding of subject content and improve learning outcomes.

Overall, the findings highlight the importance of providing adequate instructional materials and strengthening teacher training programmes to improve Civic Education curriculum implementation in schools.

Conclusion

This study investigated the availability and utilisation of instructional materials for effective Civic Education curriculum implementation in upper basic schools in Kano Central Senatorial Zone, Kano State. The findings showed that while some materials such as textbooks, charts, and real-life examples are available and frequently used, key resources like audio-visual materials and digital tools are inadequate and underutilised. The study also revealed limited opportunities for teacher professional development in the use of instructional materials. Furthermore, the results indicated that the availability and utilisation of instructional materials significantly influence effective curriculum implementation. The study therefore concludes that adequate provision and proper use of instructional resources are essential for improving the teaching and learning of Civic Education.

Recommendations

Based on the findings, it is recommended that government and educational authorities ensure the adequate provision of instructional materials, including digital resources, to support Civic Education teaching. Regular training programmes should be organised to enhance teachers' capacity to utilise these materials effectively. Schools should also be equipped with modern teaching facilities such as multimedia tools and internet access. Teachers are encouraged to adopt innovative and participatory teaching methods to improve students' engagement, while school administrators should strengthen instructional supervision to ensure effective use of available resources.

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Challenges Facing the Implementation of Educational Policies in Public Secondary Schools in North-West Zone, Nigeria

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Abstract

This study examined the challenges affecting the implementation of educational policies in public secondary schools in North-West Zone, Nigeria. Three objectives and research questions guided the study, which adopted a correlational research design. The population comprised 24,821 teachers across the seven North-Western states, with a purposive sample of 378 secondary school teachers. Data were collected using three researcher-designed questionnaires, validated by experts. Reliability was established through a test-retest method, yielding coefficients of 0.76, 0.74, and 0.84 respectively. Data were analyzed using tables, mean, and standard deviation. Findings revealed a high level of challenges in policy implementation. The study concluded that although school administrators and teachers play vital roles, their efforts are hindered by inadequate training, unclear guidelines, and limited involvement in policy formulation. It is therefore recommended that government and relevant authorities ensure adequate funding, timely resource allocation, and regular provision of instructional materials to improve policy implementation.

Keywords: Challenges, Facing, Implementation, Educational Policies, Secondary Schools

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Introduction

Education is widely recognized as a critical instrument for national development, social transformation, and human capital formation. It equips individuals with knowledge, skills, values, and attitudes necessary for meaningful participation in society and the global economy. In Nigeria, education occupies a central position in national development planning, as reflected in various educational policies aimed at improving access, equity, quality, and relevance at all levels of the education system (Federal Republic of Nigeria [FRN], 2014). Among these levels, secondary education serves as a vital bridge between basic and tertiary education, preparing students for higher learning, vocational pursuits, and responsible citizenship. Educational policies are formulated to provide clear guidelines and frameworks for achieving national educational goals. These policies encompass areas such as curriculum development, teacher recruitment and training, school administration, funding, student assessment, and quality assurance. However, the mere formulation of sound educational policies does not guarantee their success. The effectiveness of such policies largely depends on how well they are implemented at the school level (Fullan, 2016). Policy implementation is therefore a critical stage in the policy process, as it translates policy intentions into actual practice within educational institutions.

In Nigeria, the implementation of educational policies has remained a persistent challenge, particularly in public secondary schools. Despite the existence of well-articulated policies such as the National Policy on Education, the Universal Basic Education programme, and various reforms targeting curriculum and teacher development, the outcomes of these policies have often fallen short of expectations (Adewale & Oduolowu, 2019). Scholars have attributed this gap between policy formulation and outcomes to several factors, including inadequate funding, weak administrative capacity, insufficient infrastructure, teacher shortages, and poor monitoring and evaluation mechanisms (Okoroma, 2017). One of the major challenges confronting policy implementation in public secondary schools in the North-West Zone is inadequate funding. Education in Nigeria is largely financed by the government, yet budgetary allocations to the education sector have consistently fallen below international recommendations. Insufficient funding affects the provision of essential teaching and learning materials, maintenance of school facilities, teacher welfare, and capacity-building programmes (World

Bank, 2020). As a result, many public secondary schools operate under poor conditions that hinder the realization of policy objectives.

Another critical challenge is the issue of human resources, particularly the shortage of qualified teachers and school administrators. Effective policy implementation requires competent personnel who understand policy goals and possess the skills to translate them into practice. However, many public secondary schools in the North-West Zone face shortages of trained teachers, high teacher–student ratios, and limited opportunities for professional development (Ogunode & Abubakar, 2020). Administrative and leadership challenges also play a significant role in shaping policy implementation outcomes. School principals and education administrators are key actors in the implementation process, as they are responsible for interpreting policies, mobilizing resources, and supervising teaching and learning activities. Weak leadership capacity, bureaucratic bottlenecks, lack of autonomy, and poor communication between policy makers and implementers often limit the effectiveness of educational policies at the school level (Babalola, 2018). In some cases, policies are implemented without adequate consultation with school stakeholders, leading to resistance or superficial compliance. Furthermore, socio-cultural and environmental factors in the North-West Zone influence the implementation of educational policies. Issues such as poverty, child labour, early marriage, and insecurity affect student attendance, retention, and academic performance, thereby constraining the achievement of policy goals (UNICEF, 2022).

Educational policies in Nigeria are formulated to enhance access to quality education, promote equity, and improve learning outcomes at all levels of the education system. In recognition of the strategic importance of secondary education in national development, the Federal Government of Nigeria has introduced several policies aimed at improving curriculum delivery, teacher quality, school management, and student achievement in public secondary schools. Despite these policy initiatives, evidence suggests that the intended objectives of many educational policies have not been fully realized, particularly at the level of implementation. In public secondary schools across the North-West Zone of Nigeria, there is a growing concern about the persistent gap between policy intentions and actual practices in schools. Many schools continue to experience challenges such as inadequate funding, insufficient instructional materials, dilapidated infrastructure, overcrowded classrooms, and shortages of qualified teachers. These conditions undermine

effective teaching and learning and raise questions about the extent to which educational policies are being successfully implemented. Furthermore, school administrators and teachers—who are key actors in the policy implementation process—often face difficulties in interpreting and executing policy directives due to limited training, weak administrative support, and poor communication between policy makers and implementers. In some cases, policies are introduced without adequate consideration of the socio-economic, cultural, and security realities of the North-West Zone, resulting in resistance, partial implementation, or complete failure at the school level. Although several studies have examined educational policy formulation and implementation in Nigeria, there remains a paucity of empirical research that specifically focuses on the unique challenges confronting public secondary schools in the North-West Zone. The lack of region-specific evidence makes it difficult for policy makers and education stakeholders to design targeted interventions that address the actual barriers to effective policy implementation.

Objectives of the Study

The specific objectives of this study were:

- I. To identify the major challenges affecting the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria.
- II. To examine the extent to which administrative, financial and human resource factors influence the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria.
- III. To assess the roles of school administrators and teachers in addressing challenges associated with the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria.

Research Questions

The following research questions were formulated to guide the conduct of this study:

- I. What are the major challenges affecting the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria?

- II. To what extent administrative, financial, and human resource factors influence the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria?
- III. What are the roles of school administrators and teachers in addressing challenges associated with the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria?

Methodology

This study adopted descriptive survey research design. The population of the study includes all the 24,821 teachers in public secondary schools in North-West, Nigeria, which includes; Sokoto, Kebbi, Zamfara, Katsina, Kano, Jigawa and Kaduna states respectively. Table 1 indicated public secondary schools in Sokoto, Kebbi, Zamfara, Katsina, Kano, Jigawa and Kaduna states:

Table 1: Population of the Study			
S/N	States	Schools	Teachers
1	Sokoto	169	3,015
2	Kebbi	170	2,924
3	Zamfara	214	3,185
4	Katsina	122	2,856
5	Kano	363	5,109
6	Jigawa	227	3,105
7	Kaduna	260	4,627
	Total	1,668	24,821

Source: Ministries of Education & Teachers Service Boards, Northwestern states, 2025

From Table 1, there are 169 secondary schools and 3,015 teachers in Sokoto state. There are 170 secondary schools and 2,924 teachers in Kebbi state. There are 214 secondary schools and 3,185 teachers in Zamfara state. There are 122 secondary schools and 2,856 teachers in Katsina state. There are 363 secondary schools and 5,109 teachers in Kano state. There are 227 secondary schools and 3,105 teachers in Jigawa state. There are 260 secondary schools and 4,627 teachers in Kaduna state. Thus, there are 1,668 secondary schools in the seven North-West Zone States with 24,821 teachers as per Table 1.

Research Advisor (2006) table was used to determine 400 teachers out of the population of 24,821 teachers across the North-West Zone, Nigeria. Purposive sampling technique was used to select 3 states as a result of insecurity in the country. Proportionate sampling technique was also used to select teachers from various states as these 4 states were not having the same number of schools and teachers.

Table 2: Sample for the Study

S/N	States	Schools	Teachers
1	Kaduna	6	80
2	Kano	12	120
3	Zamfara	6	80
4	Sokoto	8	98
	Total	32	378

Source: Field Survey 2025

In Table 2, in Kaduna state, 6 schools and 102 teachers were selected from a population of 4627 teachers and 260 secondary schools. In Kano state 12 schools and 188 teachers were selected from a population of 5109 teachers and 363 schools. In Zamfara state 6 schools and 110 teachers were selected from a population of 3155 teachers and 214 secondary schools. In Sokoto state 8 schools and 98 teachers were selected from a population of 3,015 teachers and 169 secondary schools.

Three instruments were designed and used by the researcher to collect data from the respondents. The instruments were titled, Challenges Affecting the Implementation of Educational Policies Questionnaire (CAIEPQ), Extent to which Administrative, Financial, and Human Resource Factors Influence the Implementation of Educational Policies Questionnaire (EAFHRFIIEPQ) and Roles of School Administrators and Teachers in Addressing Challenges Associated with the Implementation of Educational Policies Questionnaire (RSATACAIEPQ). All the instruments were validated by a team of experts in the field of Educational Administration and Planning, and other experts in the Faculty of Education and Extension Services, Usmanu Danfodiyo University, Sokoto, who validated the instruments. The experts scrutinized the content of the instruments in terms of items relevance, clarity and coverage of the subject matter. Based on the expert's scrutiny, observations, suggestions, and corrections were made on the instruments before final copy was produced.

In order to ensure the reliability of the Challenges Affecting the Implementation of Educational Policies Questionnaire (CAIEPQ), Extent to which Administrative, Financial, and Human Resource Factors Influence the Implementation of Educational Policies Questionnaire (EAFHRFIIEPQ) and Roles of School Administrators and Teachers in Addressing Challenges Associated with the Implementation of Educational Policies Questionnaire (RSATACAIEPQ), the researcher carried out a pilot test of the CAIEPQ, EAFHRFIIEPQ and RSATACAIEPQ using test-retest method which was conducted within an interval of two weeks at Army Day Secondary

School Birnin Kebbi in Kebbi State. The set of scores of the pilot study obtained via test-retest for the CAIEPQ, EAFHRFIIEPQ and RSATACAIEPQ was correlated using PPMCC and the reliability indices obtained for CAIEPQ, EAFHRFIIEPQ and RSATACAIEPQ were 0.76, 0.74 and 0.84 respectively. The instruments were then adjudged to be reliable.

Results

In this section three research questions were answered and one hypothesis was tested and presented in the following tables.

Research Questions One:

What are the major challenges affecting the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria?

This research question one was answered and presented using table 3.

Table 3: Mean and Standard Deviation Ratings on Challenges Affecting the Implementation of Educational Policies in Public Secondary Schools in the North-West Zone of Nigeria

S/N	items	N	$\bar{X}$	SD	Decision
1	Inadequate funding hinders the effective implementation of educational policies in my school.	378	4.62	0.81	SA
2	Shortage of qualified teachers affects the implementation of educational policies.	378	4.48	0.86	A
3	Poor school infrastructure limits effective policy implementation.	378	4.55	0.79	SA
4	Lack of instructional materials affects the execution of educational policies.	378	4.41	0.88	A
5	Insufficient training and professional development for teachers hinders policy implementation.	378	4.36	0.91	A
6	Weak administrative leadership affects the successful implementation of educational policies.	378	4.22	0.94	A
7	Poor monitoring and supervision by education authorities hinder policy implementation.	378	4.18	0.97	A
8	Overcrowded classrooms negatively affect the implementation of educational policies.	378	4.51	0.83	SA
9	Frequent policy changes without proper guidance affect effective implementation.	378	3.87	1.02	A
10	Socio-economic and environmental factors hinder policy implementation in schools.	378	4.33	0.89	A

Mean ($\bar{X}$)	4.46	0.81	A
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Table 3 shows descriptive statistics of Mean and Standard Deviation computed to measure the challenges affecting the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. The results also revealed that most of the Mean ratings of ten items were Agreed. However, the overall mean rating of the challenges affecting the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. (Average mean = 4.46 and Standard Deviation = 0.81) implies that majority of the teachers agreed that there was challenges affecting the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria.

Research Questions Two:

What are the major challenges affecting the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria?

This research question one was answered and presented using table 4.

Table 4: Mean and Standard Deviation Ratings on the Extent to which Administrative, Financial, and Human Resource Factors Influence the Implementation of Educational Policies in Public Secondary Schools in the North-West Zone of Nigeria

S/N	Items	N	$\bar{X}$	SD	Decision
1	School administrators' leadership skills influence the implementation of educational policies.	378	4.28	0.87	A
2	Availability of adequate funding determines the extent of policy implementation in schools.	378	4.61	0.79	SA
3	Timely release of funds enhances effective implementation of educational policies.	378	4.54	0.82	SA
4	Shortage of qualified teachers affects the extent of policy implementation.	378	4.47	0.85	A
5	Teachers' workload influences their ability to implement educational policies.	378	4.12	0.93	A
6	Adequate training of teachers enhances policy implementation.	378	4.39	0.88	A
7	Effective supervision by school administrators improves policy implementation.	378	4.25	0.90	A
8	Availability of non-teaching staff supports effective policy implementation.	378	3.94	0.96	A
9	Efficient financial management practices influence policy implementation.	378	4.31	0.89	A
10	Motivation and welfare of teachers influence the implementation of educational policies.	378	4.44	0.86	A
	Mean ($\bar{X}$)		4.26	0.85	A

Table 4 shows descriptive statistics of Mean and Standard Deviation computed to measure the extent to which administrative, financial, and human resource factors influence the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. The results also revealed that most of the Mean ratings of ten items were rated agreed. However, the overall mean rating of the extent to which administrative, financial and human resource factors influence the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. (Average mean = 4.11 and Standard Deviation = 0.80) this implies that majority of the respondents agreed that administrative, financial, and human resource factors influence the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria.

Research Questions Three:

What are the roles of school administrators and teachers in addressing challenges associated with the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria?

This research question one was answered and presented using table 5.

Table 5: Mean and Standard Deviation Ratings on Roles of School Administrators and Teachers in Addressing Challenges Associated with the Implementation of Educational Policies in Public Secondary Schools in the North-West Zone of Nigeria

S/N	Items	N	$\bar{X}$	SD	Decision
1	School administrators' leadership skills influence the implementation of educational policies.	378	4.28	0.87	A
2	Availability of adequate funding determines the extent of policy implementation in schools.	378	4.61	0.79	SA
3	Timely release of funds enhances effective implementation of educational policies.	378	4.54	0.82	SA
4	Shortage of qualified teachers affects the extent of policy implementation.	378	4.47	0.85	A
5	Teachers' workload influences their ability to implement educational policies.	378	4.12	0.93	A
6	Adequate training of teachers enhances policy implementation.	378	4.39	0.88	A
7	Effective supervision by school administrators improves policy implementation.	378	4.25	0.90	A
8	Availability of non-teaching staff supports effective policy implementation.	378	3.94	0.96	A
9	Efficient financial management practices influence policy implementation.	378	4.31	0.89	A
10	Motivation and welfare of teachers influence the implementation of educational policies.	378	4.44	0.86	A
	Mean ($\bar{X}$)		4.26	0.85	A

Table 5 shows descriptive statistics of Mean and Standard Deviation computed to measure the roles of school administrators and teachers in addressing challenges associated with the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. The results also revealed that most of the Mean ratings of ten items were rated agreed. However, the overall mean rating of the roles of school administrators and teachers in addressing challenges associated with the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. (Average mean = 4.26 and Standard Deviation = 0.85) this implies

that that teacher agreed with the roles of school administrators and teachers in addressing challenges associated with the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria.

Discussion of Findings

The first finding revealed that teachers agreed with the challenges affecting the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. This finding aligns with the observations of Adewale and Oduolowu (2019), who reported that the implementation of educational policies in Nigeria has consistently faced significant challenges, particularly within public secondary schools. While the Nigerian government has established several well-structured policies, including the National Policy on Education, the Universal Basic Education programme, and multiple reforms aimed at improving curriculum delivery and teacher development, the intended goals of these policies are frequently not realized in practice. The authors highlight that despite these policies being clearly articulated on paper, their translation into effective school-level practice remains problematic, resulting in limited improvements in educational quality and learning outcomes.

Okoroma (2017) further emphasizes that the persistent gap between policy formulation and successful implementation can be attributed to a combination of systemic and institutional factors. These include inadequate funding, which restricts access to essential teaching and learning resources; weak administrative and leadership capacity, which affects planning, supervision, and decision-making; and insufficient infrastructure, which limits the ability of schools to create conducive learning environments. Additionally, teacher shortages and ineffective monitoring and evaluation mechanisms exacerbate the problem, as policies often fail to reach their full potential without skilled personnel and proper oversight. Collectively, these challenges suggest that while policy formulation in Nigeria has advanced, considerable attention is still required to address implementation bottlenecks, particularly in the context of public secondary schools.

The second finding revealed that teachers strongly agreed with the extent to which administrative, financial, and human resource factors influence the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. This is in line with the work of Babalola, (2018) who mentioned that administrative and leadership challenges also play a

significant role in shaping policy implementation outcomes. School principals and education administrators are key actors in the implementation process, as they are responsible for interpreting policies, mobilizing resources, and supervising teaching and learning activities. Weak leadership capacity, bureaucratic bottlenecks, lack of autonomy, and poor communication between policy makers and implementers often limit the effectiveness of educational policies at the school level. In some cases, policies are implemented without adequate consultation with school stakeholders, leading to resistance or superficial compliance.

The third finding revealed that teachers agreed with the roles of school administrators and teachers in addressing challenges associated with the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. The findings aligned with the work of Babalola, (2018) who noticed that school principals and education administrators are key actors in the implementation process, as they are responsible for interpreting policies, mobilizing resources, and supervising teaching and learning activities. Weak leadership capacity, bureaucratic bottlenecks, lack of autonomy, and poor communication between policy makers and implementers often limit the effectiveness of educational policies at the school level.

Conclusion

This study examined the challenges facing the implementation of educational policies in public secondary schools in the North-West Zone of Nigeria. The findings highlight that, despite the existence of well-articulated educational policies aimed at improving the quality and effectiveness of secondary education, significant obstacles continue to hinder their successful implementation at the school level. Key challenges identified include inadequate funding, shortages of qualified teachers, poor infrastructure, weak administrative capacity, and limited monitoring and supervision mechanisms. The study also revealed that school administrators and teachers play a crucial role in the policy implementation process; however, their efforts are often constrained by insufficient training, unclear policy guidelines, and minimal involvement in policy formulation. Additionally, contextual factors such as socio-economic conditions, security challenges, and cultural practices in the North-West Zone further complicate the implementation of educational policies in public secondary schools. Based on these findings, it can be concluded that effective implementation of educational policies requires more

than sound policy formulation. It demands adequate resource allocation, strengthened leadership and administrative capacity, continuous professional development for teachers, and policy strategies that are sensitive to local realities. Addressing these challenges is essential for bridging the gap between policy intentions and actual practice, thereby improving the quality of secondary education in public schools within the North-West Zone of Nigeria.

Recommendations

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

- I. Government and relevant education authorities should address the major challenges identified by ensuring adequate funding, timely release of resources, and regular provision of instructional materials to public secondary schools in the North-West Zone of Nigeria.
- II. Education stakeholders should strengthen administrative, financial, and human resource capacities through improved school management systems, recruitment of qualified teachers, and continuous professional development programmes for school personnel.
- III. School administrators and teachers should be actively involved in policy planning and implementation processes, with regular training and support to enhance their understanding of policy objectives and improve effective execution at the school level.

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Philosophical Examination of Integrated Education System in Nigeria

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Abstract

The main thrust of the study was to examine in depth integrated education system in Nigeria. Speculative, Prescriptive, Analytic and Dialectic philosophical modes of investigation were adopted alongside with the use of Key Informant Interview (KII) for the study. It was discovered by the study that the concept of integrated education system is polemical in nature and has been given varied, divergent and confusing interpretations. The researcher through the instruments of analysis was able to destroy wrong perceptions, interpretations, and inappropriate interpretation of integrated education system and presented the correct interpretation of integrated education system as the marrying together of all educational experiences such as the formal, informal and non-formal education systems to produce one whole and integrated individual. It was found by the study that Nigeria's government has made tremendous efforts towards integrated education system but fail to set up a body for linking the three educational systems together. The study concluded by advocating for the establishment of a body which would develop formal modalities for linking all the three educational systems in the country. It also advocated for the establishment of vocational training centres for all primary and secondary schools in the Nigerian communities nationwide. Local master craftsmen from within the communities are to be employed and paid by the government to teach their various skills to these pupil/students. Pupils/students in primary/secondary schools are to attend formal schools concurrently with vocational training for skill acquisition.

Keywords: Challenges, Facing, Implementation, Educational Policies, Secondary Schools

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Introduction

The yearning for educational quality, quantity and access has been the major concern of all countries around the globe with Nigeria not an exception. Although Nigeria has made some recent strides towards boosting coverage and standards in education, the existing European-style system is still characterized by ‘poor quality; dilapidated infrastructure; lack of basic instructional materials and furniture; high rate of unqualified teachers; weak and under-resourced channels of decision making; and weak relationship between parents and schools (Rasheid, 2015). In addition to this, UNESCO reported low enrolment rate of school-aged children of 10.5 million (out-of-school children of primary school age) in Nigeria (UNICEF DATA, 2019). Unfortunately, major educational concentration of nations over the years had been on the European- style system that is, formal education system. Formal education has however over the years been limited by the problem of access, problem of quality and quantity, and the problem of its meeting the felt needs and aspirations of societies (Willems 2017). Jurgen pointed further that “our traditional system of formal education – with a teacher or a professor in front of a classroom of passive listeners, backed up with a blackboard and lots of chalk – is becoming increasingly unfit for purpose; today’s world needs so much more, especially in a fast-changing society with substantial technological advancements and unlimited global connectedness, and lifelong learning” (Willems 2017). On his part. Bagudo (2018) accused formal education of producing jobless graduates who roam the streets of Nigeria in search of jobs which are not easy to come by, and that the education offered through the modern school system is well known to be most often divorced from the people’s needs, aspirations, and desired future life situations and opportunity. He reported further that available evidences show that drop-outs and a good number of youths who graduate from the formal school system roam the streets in search of white-collar jobs which they couldn’t find when they finish school.

The Jomtien Thailand educational convocation of 1990 provided a forum where nations of the world met to brainstorm on these problems. The outcome of the convocation strengthened the emphasis on “Education For All” (EFA) as a response to the problem of access, quantitative and qualitative education programmes were conceived as measures to tackle the problem of quality and quantity, and a demand was equally made on nations to diversify their

educational programmes beyond the formal education system, and to tailor such programmes into meeting the felt needs and aspirations of the society (<https://www.encyclopedia.com>).

Following suit, the Organization for Economic Co-operation and Development (OECD) undertook several studies on promoting the importance of lifelong learning and career development, a reality for reshaping learning to match the needs of the 21st century knowledge economy and open societies. Such international studies included the Identification, Assessment and Recognition of formal, informal and non-formal learning, Transfer between formal, informal and non-formal education and Making Learning Visible (OECD, 2003). The studies also submitted a report on the need for diversification and recognition of non-formal and informal education as pivotal for lifelong learning.

Essentially, the outcome of the Jomtien Thailand convocation and the OECD reports as well as the criticisms labelled against formal education in its failures in meeting the felt needs and aspirations of the society served as propellants to nations to refocus their attention on other forms of education which had hitherto though in existence, been neglected and sacrificed for formal education system. This awareness subsequently exhumed a renewed interest and attention on the informal and non-formal education and other educational systems. The examination of the advantages inherent especially in the three education systems (formal, informal and non-formal) birthed the idea of their integration, and subsequently the springboard for integrated education system globally, and became an education policy, embedded in the National Policy of Education in 1986 in Nigeria (Amruta, 2020).

What then is integrated education system all about? Bagudo, (2018) describes integrated education system as the process by which all the diverse educational efforts in the nation such as the informal, non-formal and formal educational platforms are compacted into relatively simple and permanent system, with the sole aim of moulding and producing one whole and integrated individual. It is the marrying together and utilising all educational experiences available to a nation for the purpose of moulding or producing a balanced individual. It entails that all educational efforts such as the informal, non-formal, formal education, which are though varied in their functions, formations and institutionalizations to be summed up to cohere into producing a whole organism - a total human being.

Presently the idea of integrated education system has gone beyond the marriage of the three educational systems of formal, non-formal and informal to alternative education, entrepreneurship and shadow education to all educational experiences available to a nation for the purpose of moulding or producing a balanced individual, well equipped to live meaningfully and successfully for himself and to the society in which he lives and belongs (George, 2017).

Brief overview of Nigeria's educational system

Looking at Nigeria's educational system reveal an array of three major (players) educational providers namely, the formal, informal and non-formal educational systems respectively. The formal system according to Dib, (1988) corresponds to a systematic, organised education model, structured and administered according to a given set of laws and norms. It presents a rather rigid curriculum as regards objectives, content and methodology. It is characterized by a contiguous education process which necessarily involves the teacher, the student and the institution. Education provided by nursery schools, primary, secondary and tertiary institutions such as the colleges of education, polytechnics, monotechnics and universities all fall under this category.

The informal educational system on the other hand is a general term for education that can occur outside of a structured curriculum. It is the African traditional education system which is closely intertwined with the daily life of the African people with the idea that children learnt what they lived Claudio Z. Dib, (1988) buttresses further that the philosophy of traditional African education suggests that one's education cannot be separated from the everyday life and the "curriculum" is thus considered a way of life with the ultimate goal being to create a complete individual, and a lifelong learner. Education received from local blacksmiths, fishermen, carvers of woods, skin tanners, farmers, hair dressers, tillers, potters, carpenters etc are mostly of informal nature.

The Non formal education is described as an organized educational activity outside the existing formal system in order to meet the educational needs of a particular group / public that seeks clear learning objectives. It is organized, has curriculum and flexible time table with completion period based on the contact hours. The recipients are called learners and they are regarded as

matured and experienced. Textbooks in this sector are called primers as they are specifically written for easy assimilation. The place of learning is called “center” and not schools and they are often chosen or selected by the learners. The teachers in this sector are called facilitators who are expected to have androgogical skills. Examples of non-formal education include National Open University of Nigeria (NOUN), Centre for Continuing Education, Distance Learning, Open Systems, B.Ed Part Time Programmes etc.

The integrated education system (IES) essentially advocates that these main educational providers which make up Nigeria’s educational system as a whole should be integrated so that students at completion of their educational pursuits would have been moulded to have a whole round experience from these three major educational providers. IES holds that a child should not only be educated formally without the informal and non-formal educational experiences, and vice versa and that the marrying of these three educational experiences will result into producing a whole individual who is not deficient in any form, an individual with a certificate in one hand and skills for lifelong living in the other.

Statement of the Problem

The problem of integrated education system, however, stems even from the conception of the policy itself. One problem area of the policy lies in the interpretation attributed to it, and we all know that a misunderstood policy cannot be implemented rightly. A question as to what the policy is all about revealed a whole lot of conflicting and confusing responses. There tends to be so many confusing and conflicting interpretations given to the policy, and as we all know that clarification of meanings is central to philosophical discourse.

Another problem area lies on how the various heterogeneous educational systems could be integrated in practice. How possible in practice can formal, informal and non-formal educational systems be integrated as one considering how the conventional or formal system of education characterized by their daytime class sessions, residence- and age-based enrolments, teacher-delivered standards for national curricula, nine-year learning cycle (of basic education), and their almost exclusive focus on urban and future-oriented knowledge and cognitive competencies with a “stand-alone” or individuality spirit that had long existed away from the other forms of education be married together? Roslyn C. (2012) held that in practice, there are no any observable

interactions or linkages among the three forms of education which showcases integration rather, what is seen in practice is each form of education standing and operating alone. Bagudo, (2018) shared a similar view in saying that there appears to be walls of division even among the levels of formal education; the university stands or operates alone away from the polytechnics, monotronics, colleges of education, school of nursing and vice versa, and even among the various universities in the nation, there is no much meaningful element of inter dependence rather, what characterizes them is autonomy; each university operates entirely of its own and with its own government. The question therefore is, if within the formal education system there exists watertight compartments such that each level closes its doors against the other among its various levels, how much more or what do we expect of its operations with other types of education such as the informal and the non-formal education which are outside its domain, considering moreover the fact that the formal education system has registered and enjoyed its superiority and dominance over the years on the other forms of education?

To further worsen the problems surrounding the policy is the argument that integrated education system policy is not possible and therefore needless Claudio Z. Dib (1988). These positions essentially constitute problem areas of which the researcher explored using his philosophic lenses.

Research Objectives

The objectives of the study are as follows:

- I. To explore, interpret and analyze the meaning of integrated education
- II. To examine what philosophers like Whitehead and others scholars say on integrated education.
- III. To explore the justification for integrated education system globally and in Nigeria.
- IV. To find out how integrated education system can be operated in practice

Research Questions

The following questions were raised whose answers were sought in the course of the study

- I. What is the idea of integrated education system all about?
- II. How did philosophers like Whitehead and other scholars around the globe view integrated education?
- III. Why should we have integrated education system in Nigeria?
- IV. How can integrated education system be operated in practice?

Theoretical Framework

Whitehead's philosophy of organism begins with "the analysis of process as the realization of events disposed in an interlocked community (<https://philosophynow.org/issues/114>). Actual occasions, as the final realities of which the universe is composed, are self-creating buds of experience, each one uniquely itself even while it remains internally related to every other occasion in the creative community of the universe. Whitehead always believed that appreciation of the whole to the part was central to understanding reality. Relatedness is fundamental. To Whitehead, nothing is in isolation. All things depend on each other. 'Everything in this world is in some way connected with every other thing in this world: "Everything is part of the whole". Whitehead's philosophy urges us to turn from reductionism, and, to instead think of the whole in relation to the parts and the parts in relation to the whole.

Methodology

The study adopted the three modes of philosophical study: the speculative, prescriptive and analytic modes. Dialectics were heavily employed in the study. The work also adopted the use of Key Informant Interview.

The speculative mode: This falls within the domain of metaphysics. It was used to raise questions as to that which perplexes or amazes the mind on issues throughout the study. Beginning from the setting of the research questions in chapter one to review of literature, analysis and appraisals, the speculative mode was applied. It also found expression in all the questions raised in the

course of dialectics in the work. In short, all the “Whats, Whys, Hows” in the work sprang from, and were the application of the speculative mode.

The prescriptive method: This falls within the domain of ethics. It was used in the study to prescribe action intervention strategy to solving pertinent problems associated with the implementation of integrated education system in Nigeria. It was employed to offer suggestions and recommendations on issues of inadequacies, inappropriateness or problems generated from propositions (thesis) and antithesis in the study.

The analytic method: This is in order word called logical positivism. The analytic method as the name implies was employed to dissect and separate aspects or elements of issues pertaining integrated education in regards to the central meaning of integrated education system in Nigeria. It was used to make relevant distinctions and clarifies concepts, phrases or words to remove ambiguities so that their true meanings would be known for the purpose of prescribing that which is appropriate and the inappropriate. Various propositions by scholars on integrated education system were generated and analyzed using the method. The product of the analysis was then compared with Whitehead’s theory of organism and process thought which served as the theoretical framework for the study and on which the idea of integrated education system emerged.

Dialectics: The dialectical method is a process of construction and deconstruction of ideas which ends up by destroying untrue elements in both the proposition-thesis and the antithesis thereby presenting a synthesis or a new proposition which embodies the true elements of both the thesis and the antithesis¹³. In dialectics ideas are constructed in the course of intellectual discourse. In it, a proposition or thesis is identified; it is then challenged or criticized by a counter proposition called the antithesis, a synthesis of both the thesis and antithesis is made and the true elements in both are upheld and the formation of a new thesis is made from the true elements of the thesis and antithesis. The researcher adopted this to construct and deconstruct ideas raised on the conception of integrated education system by various scholars in relation to the central meaning of integrated education derivable from Whitehead’s Philosophy of Organism which provided the theoretical framework of the study.

The researcher adopted the use of Key Informant Interview (KII) based on the professional advice of the team of experts in the faculty. The questions used for the KII were validated by experts in the faculty. The researcher visited and interviewed the heads of Islamic Trust Foundation (ITF) Sokoto, Evangel Bible Club (J. Allen) Sokoto, National Directorate of Employment (NDE) Sokoto Head office, the coordinator of Students Industrial Work Experience Scheme (SIWES) Usmanu Danfodiyo University Sokoto and the Directorate of Entrepreneurship Centre, Usmanu Danfodiyo University Sokoto state. Others interviewed were local crafts men (blacksmiths) at Kara in Sokoto, motor mobile mechanics and carpenters. Responses from the Key Informant Interviews (KII) were recorded and afterward qualitatively analyzed through the process of Transcription, The matization, Annotation and Interpretation.

Result

It was discovered by the study that the concept of integrated education system is polemical in nature and have been given varied and divergent interpretations. Some scholars as shown in the study misinterpreted integrated education system for inclusive education, others as alternative education. The researcher through the instruments of analysis was able to identify wrong perceptions, interpretations, inappropriate presentations of integrated education system and drew a line of demarcation between what is meant by integrated education and what is not and presented the correct interpretation of integrated education as the marrying together of all educational experiences such as the formal, informal and non-formal education systems with the sole aim of producing one whole and integrated individual in line Whitehead's process thought theory.

It was shown by the study that the idea of integrated education system sprouts out from Whitehead's philosophy of 'organism and process thought' which held that everything in this world is in some way connected with every other thing in this world, for every organism is made of different components and each of the component is important and functions not in isolation but in cooperation to other component parts. Integrated education system was adopted and embedded as a Policy of Education in Nigeria in 1986. It was found out by the study that the numerous weaknesses labelled against the formal education system in Nigeria and globally beckoned for non formal and informal education systems and consequently the birth of integrated education system. Formal education system has been accused heavily of producing

jobless graduates who roam the streets in search of jobs which are not easy to come by and that the education offered formally is mostly divorced from the people's needs, aspirations and desired future life situations etc. These weaknesses stimulated or exhumed the renewed interest in the exploration of other alternative education systems was strengthened by the Jomtien Thailand educational convocation of 1990

The study found out that integrated education system could be operated in practice through curricular flexibility approach to education, culturally responsive school environment, mainstreaming integrated education centres, Community – based approach, strengthening and maintaining strict compliances to SIWES and entrepreneurship education in higher institutions of learning could enhance integrated education system in Nigeria.

Lastly, the study found out that the Nigerian government has made tremendous efforts on the three educational platforms (Formal, Informal and Non formal) but has failed to set up a body to develop modalities of linkage among these key educational players in the country.

Challenges to integrated education system in Nigeria

- I. No comprehensive and methodologically—sound researches into specific needs and interests of all categories of people, the adult, the children with special needs. No census with adequate data to specifically detect the educational needs of every Nigerian to ensure adequate planning for meaningful integrated education system in Nigeria.
- II. Curricular rigidity of the formal education system makes it not to absorb some important elements of the other forms of education. This makes it to operate under water tight compartments against other educational systems.
- III. Inadequate funding: The Federal Government of Nigeria's inability to fund general education has led to the total abandonment of any request for setting up suitable structures for other forms of education. The less than 20% UNESCO educational standard allocation makes it very difficult to fund adequately all the educational systems in the country.

- IV. Government over concentration on the formal education at the expense of other educational efforts further weakens the development of integrated education in Nigeria. Government emphasis on education is mostly at times focused on the formal system while the other systems that is, the informal and non-formal systems are neglected. Most operators of informal and non-formal education are mostly neglected in terms of funding by the government.

Conclusion

Nigerian government has indeed made commendable efforts on integrated education system reflected especially at the tertiary levels of education through SIWES and Entrepreneurship Education. The introduction of National Open University, Centres for Continuing Education, Adult and Non-Formal Education (ANFEA) among many others. The introduction of the policy has greatly boosted the development of the country in the education industry curbing seriously the menace of education access and illiteracy.

The study concluded however that vocational training centre (s) should be established by the government to serve all primary and secondary school students in the Nigerian communities nationwide just as SIWES and Entrepreneurship Centres in tertiary institutions. They are to be established in a way that each centre should serve a particular named school. Local master craftsmen from the communities are to be employed and paid by the government to teach their various skills to students of both primary and secondary schools in their community. Students are to run formal learning (formal education) in school concurrently with vocational training (non formal). They are to attend formal schools in the morning and vocational training centres in the afternoon. The curriculum and time table of formal schools should be adjusted to reflect this change. This would go a long way in ameliorating the problems of unemployment which formal education system has heavily been accused of.

The study also concluded that the National Youth Service Corp (NYSC) programme be reformed. That within the one year of service, all graduates in camps are to be exposed to, and be trained on various skills and vocations such as tailoring, weaving, plumbing, dish installations, carpentry, tilling, furniture works, fulcanizing, electric wiring, dyeing, fishery, poultry etc, and be certificated on the skills they have so learned. Vocational skills centres should be opened in the orientation camps in all the states and local

government areas of the nation for easy access by the corp members on camp. On passing out these corp members should be provided with equipments and kick off grants by the government to practice what they have so far learned, so as to be self- reliant. This would reduce the rate of unemployment and turn job seekers on passing out to be employers of labour. It would also provide a balance of the three forms of education.

Recommendations

In order to curb the challenges of integrated education system in Nigeria, the following recommendations were made:

- I. There is the need for a policy reform to show more commitment to integrated education in Nigeria especially at primary and secondary levels of education. This would involve the establishment of vocational training centres by the government nationwide where skills provided by local master craftsmen could be learned by students thereby tailoring education to meet the economic and social needs of society. Equally, an urgent census specifically to detect the educational needs of every Nigerian is necessary to ensure adequate planning for integrated education in Nigeria. The literacy programmes of the federal government should be vigorously pursued to ensure the removal of the prejudice and stereotype behaviours of people to other forms of education than the formal school. Provisions in the UBE act for basic education should include adequate learning and recreational facilities and equipment to cater for all forms of education in Nigeria.
- II. A special directorate for integrated education system should be created in the federal and state ministries of education charged with the responsibilities of planning, strategizing, implementing, and monitoring of integrated education activities in Nigeria. Membership should include representatives of ministries of education, ANFEA, SAME, SUBEB and National orientation agency.
- III. The curriculum of the formal system should be made flexible to absorb elements of the other forms of education; there is the need for massive retraining of the teachers of regular schools in integrated education pedagogies and skills. They are also to be trained not only in

the teaching of theories but also in entrepreneurial and lifelong skills which would be of great value to students on graduation.

- IV. There is the urgent need to set up community coalition groups to build up programmes that target the whole community. The programmes are to create awareness and sensitivity for all members of the community to embrace all forms of education offered by the government. Parents who are the custodians of children would need to see the importance of education, not only for their children alone but for themselves as well. Those who dropped out from formal school could get the opportunity to continue or even engage in other forms of education. This awareness would translate into more enrolment of children thereby reducing or possibly eradicating illiteracy nationwide.

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Principals' Leadership Capacity and Teacher Productivity in Secondary Schools in Kebbi State, Nigeria

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Abstract

This study examined the leadership capacity of principals in ensuring equitable resource distribution and its influence on teacher productivity in secondary schools in Kebbi State, Nigeria. Two research objectives and research questions were raised to guide the study. Adopting a descriptive survey design, the population comprised 104 principals and 4,272 teachers, from which a sample size of 357 was drawn using research advisor table 2006, respondents were selected through stratified and simple random sampling techniques, data were collected using the Principals' Resource Management Questionnaire (PRMQ) which was validated by experts and a Cronbach's alpha reliability coefficient of 0.73 was achieved. Findings indicate that principals demonstrate strong capacity in key administrative areas, including needs-based budgeting, ensuring access to facilities, and managing core staffing logistics like recruitment and assignment by expertise. However, significant gaps were identified in strategic leadership domains: principals showed limited effectiveness in distributing experienced teachers equitably, providing targeted support for struggling students, fostering collaborative mentorship, ensuring adequate physical working conditions, and building inter-school partnerships. The study concludes that while principals are proficient operational managers, their capacity for transformative, equity-focused leadership that directly enhances teacher productivity through collaborative culture and strategic resource responsiveness requires substantial development. Recommendations include targeted training and policy reforms to address these identified gaps.

Keywords: Principals-Leadership, Teacher Productivity, Secondary School

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Introduction

Globally, principals are recognized as key actors in the management of secondary schools, serving not only as instructional leaders but also as resource managers who shape the organizational climate. Their leadership capacity determines how effectively schools achieve their mandates of quality teaching and learning. Recent studies such as Nwachukwu and Nwosa and Orunbon & Nwogu emphasizes that principals' strategic leadership approaches directly influence teacher performance and student outcomes, underscoring their role as both administrators and vision-bearers in educational systems (Nwachukwu & Nwosa, 2025). In contexts where resources are scarce, the principal's ability to mobilize, allocate, and monitor institutional resources becomes even more critical, as it ensures that teachers are adequately supported to deliver on their instructional responsibilities (Orunbon & Nwogu, 2025).

Equitable distribution of resources is central to effective school leadership, as it guarantees fairness and inclusivity in access to teaching materials, infrastructure, and professional development opportunities. Principals who demonstrate capacity in equitable resource allocation foster environments where teachers feel valued and motivated, thereby enhancing productivity. Principals prioritize fairness in resource distribution, teachers are more likely to engage in innovative practices and sustain high levels of commitment to their duties (Makera, Mahmud & Kwashabawa, 2024). Conversely, inequitable distribution often leads to dissatisfaction, low morale, and diminished instructional quality. Thus, equitable resource management is not merely administrative but a leadership function that directly impacts the effectiveness of secondary education.

Teacher productivity is closely tied to the adequacy and fairness of resource distribution. Equitable access to teaching aids, conducive classrooms, and opportunities for professional growth enable teachers to focus on instructional delivery rather than resource struggles. Equitable resource allocation enhances teacher job satisfaction and performance, thereby improving student learning outcomes (Nwachukwu & Nwosa, 2025). However, Nigerian secondary schools continue to grapple with systemic issues in resource distribution, including inadequate funding, politicized allocation, and infrastructural deficits. These challenges often result in disparities across schools, where

some institutions are better equipped than others, creating inequities that undermine teacher productivity and student achievement (Makera et al., 2024).

The persistence of unequal resource distribution in Nigerian secondary schools has been linked to broader governance and policy gaps. Problems such as favouritism, mismanagement, and lack of accountability in resource allocation exacerbate inequities, leaving many teachers demotivated and unable to perform optimally (Orunbon & Nwogu, 2025). While several studies have examined principals' leadership practices in relation to teacher performance, few have specifically focused on Kebbi State, where contextual realities such as rural-urban disparities and limited institutional support present unique challenges. This research therefore seeks to fill this gap by assessing principals' leadership capacity in ensuring equitable resource distribution and its influence on teacher productivity in Kebbi State secondary schools.

Review of Related Literature

Principals in secondary schools are expected to demonstrate strong leadership capacity by ensuring equitable distribution of institutional resources, thereby creating supportive environments where teachers can thrive and maximize productivity. In such a situation, resources would be fairly allocated across schools, teachers would have access to adequate teaching materials and professional development opportunities, and student learning outcomes would improve as a result of motivated and effective teachers ((Makera, Mahmud, & Kwashabawa, 2024). However, in practice, many secondary schools in Nigeria, including those in Kebbi State, face persistent challenges in resource distribution. Inequities arise from inadequate funding, favoritism, mismanagement, and rural–urban disparities, which often leave some schools better resourced than others. These imbalances negatively affect teacher morale, reduce instructional quality, and widen performance gaps among schools. While existing studies have examined principals' leadership practices and teacher performance broadly, few have specifically addressed how principals' leadership capacity influences equitable resource distribution and teacher productivity in Kebbi State. This gap in knowledge underscores the need for research that investigates the extent to which principals in Kebbi State secondary schools exercise leadership capacity in ensuring fairness in resource allocation and how such practices impact teacher productivity (Makera, Mahmud, & Kwashabawa, 2024).

Principals' leadership capacity encompasses the knowledge, interpersonal competence, and strategic influence that enable school leaders to steer instructional quality and organisational functioning toward continuous improvement. Studies shows that strong leadership capacity emerges through sustained professional learning, reflective practice, and collaborative problem-solving structures that allow principals to diagnose instructional gaps and coordinate schoolwide improvement (Muhayimana et al., 2023). Building on this, large-scale syntheses emphasise that principals influence student learning primarily by shaping the conditions under which teachers work, particularly through staff motivation, instructional supervision, and strategic resource allocation (Grissom et al., 2021). Therefore, leadership capacity is best understood not as an individual trait but as a dynamic institutional capability that develops when school systems provide coaching, feedback loops, and organisational supports that help principals translate leadership knowledge into everyday practice.

Equitable resource distribution refers to the extent to which educational resources teachers, instructional materials, infrastructure, and funding are allocated based on need rather than equal numerical shares. Evidence increasingly shows that systems often misinterpret equality for equity, resulting in disadvantaged schools having fewer qualified teachers, weaker infrastructure, and insufficient learning materials even when per-pupil spending appears uniform (Omoeva et al., 2021). The outputs-based framework proposed by Omoeva, Menezes Cunha, & Moussa, (2021) has been influential in demonstrating that fairness in resource allocation must consider contextualised demand indicators such as student disadvantage, school location, and staffing gaps. Such data-driven approaches strengthen the capacity of ministries to correct mismatches and to design formulae that prioritise vulnerable schools, ensuring that resource distribution reflects both instructional demand and systemic improvement goals.

Teacher productivity reflects the extent to which teachers effectively convert professional knowledge, instructional time, and organisational support into improved student learning and school functioning. Empirical studies show that productivity increases when teachers have access to structured professional development, ongoing feedback, and enabling working conditions that reduce administrative overload and increase time for lesson planning and collaboration (Hornido et al., 2024). Scholars consistently argue that teacher

productivity is shaped by a combination of motivational factors, workplace resources, and leadership support, meaning that even highly skilled teachers are less productive when resources are insufficient or school leadership is weak. Consequently, enhancing teacher productivity requires coordinated attention to teacher competence, workplace conditions, and the larger institutional environment.

Principals' leadership capacity, equitable resource distribution, and teacher productivity form a mutually reinforcing system that determines school effectiveness. Principals with strong leadership capacity are better positioned to advocate for and strategically allocate resources in ways that respond to school-level needs (Muhayimana et al., 2023; Grissom et al., 2021). When such allocations are equity-driven, schools become more capable of providing teachers with the tools, materials, and conducive working conditions that enhance productivity (Omoeva et al., 2021). In turn, higher teacher productivity reinforces effective school leadership, as improved instructional outcomes generate the feedback and organisational stability needed for leaders to refine their practices (Hornido et al., 2024). This synergy underscores that sustainable school improvement requires deliberate coordination across leadership development, resource equity, and teacher support systems rather than isolated reforms.

Objectives

The objectives of the study are as follows;

- I. To assess the extent of principal's leadership capacity on equity distribution of resources allocated to schools for teacher's productivity in Kebbi State.
- II. To determine ways in which principal leadership capacity influences teacher's productivity of secondary schools in Kebbi State.

Research Questions

The following research questions are formulated to guide the study;

- I. What is the level of principals' leadership capacity in ensuring equitable distribution of institutional resources for teachers in Kebbi State secondary schools?

- II. In what ways do principals' leadership practices influence teacher productivity in Kebbi State secondary schools?

Methodology

The study employed a descriptive survey research design. The population comprised 104 principals and 4,272 teachers, from which a sample size of 357 was determined using research Advisor table 2006, respondents were selected through stratified and simple random sampling techniques. Data were collected using instrument titled Principals' Resource Management Questionnaire (PRMQ), which was validated by experts and achieved a Cronbach's alpha reliability coefficient of 0.73 from a pilot study involving 50 respondents. The questionnaire was administered personally with the assistance of trained research assistants, ensuring voluntary participation and confidentiality. Collected data were analyzed using SPSS, employing mean and standard deviation to answer the research questions.

Results

This section will present results of data analysis and interpretations.

A decision rule of 2.5 was adopted as the criterion mean. Items with a mean score of 2.5 and above were considered accepted, showing agreement among respondents, while items with a mean score below the threshold (2.5) were rejected.

RQ1: What is the level of principals' leadership capacity in ensuring equitable distribution of institutional resources for teachers in Kebbi State secondary schools?

Research question one will be answered using table 1 below.

Table 1: Principals' Equitable Distribution of Resources for Teachers Productivity

S/N	Items	N	Mean	SD	Remarks
1	Principals' allocation of school budgets is done according to needs-based funding formula.	357	3.43	.574	High
2	The principal distributes school resources without regard for students' demographic and socio-economic background.	357	2.77	1.374	Moderate
3	Principals ensure that equal rewards are awarded to deserving students.	357	3.60	.683	High

4	The principal makes sure that all students have access to curriculum aligned with empowerment and grade-level standards.	357	3.49	.635	High
5	School Principals give more resources to their struggling students in areas where they are lacking.	357	2.79	.893	Moderate
6	Principals make sure that students have equal opportunities to use the library and laboratory in the school.	357	3.49	.599	High
7	Teachers with more experience and credentials are distributed equally among classes within the school.	357	2.84	1.144	Moderate
8	The principal ensure that all the students have equal opportunities to choose their school subjects with the resources devoted for the subjects.	357	3.29	1.101	High
9	Principals give students equal opportunities to borrow resources like textbooks for home work.	357	3.31	.589	High
10	Schools give students equal opportunities to nurture their talents by allowing every student to use the school sporting facilities and the school farm.	357	3.48	.708	High
Grand Mean = 3.25					

The results presented in Table 1 indicate that principals demonstrate substantial leadership capacity in ensuring equitable distribution of school resources. Items 1, 3, 4, 6, 8, 9, and 10 all recorded mean scores above the decision benchmark of 2.50, suggesting strong agreement that principals allocate budgets using needs-based criteria, provide equitable rewards, and ensure that all students have access to curriculum, library, laboratory, subject choices, sporting facilities, and agricultural resources. However, the table also shows that items 2, 5, and 7 scored only slightly above the decision mean, indicating weaker leadership capacity in several areas. These include limited consideration for struggling learners during resource allocation, inconsistent distribution of instructional resources, and inadequate deployment of teachers across classes. Collectively, the interpretation of Table 1 suggests that while principals exhibit strong capacity in major domains of resource equity, notable gaps remain in addressing the needs of low-performing students, ensuring fair teacher distribution, and strengthening holistic resource responsiveness across classrooms. The grand mean (3.25) shows that principal's equitable distribution of resources for teachers' productivity is highly rated by the respondents indicating a very high level of agreement.

RQ2: In what ways do principals' leadership practices influence teacher productivity in Kebbi State secondary schools?

Research question two will be answered using table 2 below.

Table 2: Principals' Leadership Capacity in Teachers Productivity

S/N	Items	N	Mean	SD	Remark
1	The principal ensures that all subjects are being taught by qualified teachers.	357	3.76	.619	High
2	The principal has the ability to attract and retain best teachers in the school.	357	3.84	.536	High
3	The principal usually fosters a more collaborative school culture.	357	2.72	1.035	Moderate
4	The principal infuses relevant staff professional development opportunities to help students.	357	3.11	.867	High
5	Principals usually match experience teachers with less experience teachers in the school.	357	2.79	.913	Moderate
6	The principal develops formal and informal partnerships with other school Principals to keep tract of high-quality or experience teachers.	357	2.64	.985	Moderate
7	Principals ensure that assigning of teachers to classes is based on their area of expertise.	357	3.51	.791	High
8	Principals make provision for ventilation system, toilets, and photocopy machines for a comfortable physical working condition of teachers.	357	2.82	1.344	Moderate
9	Principals employ P.T.A staff in the school based on objective laid down procedure rather than favoritism.	357	2.78	1.121	Moderate
10	Principals always make effort to replace staff in case of leave, transfer, resignation and retirement.	357	3.66	.738	High

Grad Mean = 3.16

The analysis of Table 2 indicates that principals are perceived to be effective in certain specific areas of staff development and training but moderately effective in others. Respondents strongly affirmed the principal's capacity to handle staffing logistics, such as attracting qualified teachers, assigning them to their expertise areas, and permitting professional development. However, principals received only moderate ratings in areas requiring strategic collaboration, mentorship, and improving the physical work environment, suggesting significant room for growth in these domains.

An analysis of respondent feedback on principals' capacity for staff development and training (see Table 2) reveals a bifurcated set of competencies. The findings indicate that principals are perceived as highly effective in several key operational areas. Specifically, respondents strongly affirmed (with mean scores above the decision point of 2.5) the principals' capacity to attract and retain qualified teachers for all subjects, encourage and permit staff professional development, assign teachers based on their expertise, and manage staff replacements due to attrition.

Equally, principals received only moderate affirmation in areas related to fostering a collaborative and supportive school culture. This includes a lesser capacity to pair experienced with less-experienced teachers for mentorship, develop partnerships with other schools to track high-quality teaching talent, provide adequate physical working conditions (e.g., ventilation, toilets, photocopiers), and employ Parent-Teacher Association (P.T.A) staff. This pattern suggests that while principals are proficient in direct administrative and logistical functions concerning staff management, their strategic and formative roles in building a collaborative professional community and ensuring a comfortable work environment require further development. The grand mean score of 3.16 indicates that principals' leadership capacity in teachers' productivity is perceived to be high by the respondents.

Findings

- I. Principals generally demonstrate strong leadership capacity in equitably distributing school resources, especially in budgeting, access to facilities, and fair reward systems. However, weaknesses remain in supporting struggling students, distributing teachers evenly, and ensuring balanced allocation of instructional resources.
- II. Principals demonstrate effective administrative capacity for staff management such as recruitment, assignment by expertise, and approving professional development but show limited effectiveness in fostering collaborative mentorship, inter-school partnerships, and ensuring adequate physical working conditions.

Discussion

Findings from research question one revealed that, Principals have the capacity of equitable distribution of resources for teachers productivity with

allocation of school budgets been done according to needs-based funding formula, ensuring that equal rewards are awarded to deserving students, they make sure that all students have access to curriculum aligned with empowerment and grade-level standards, make sure that students have equal opportunities to use the library and laboratory in the school, ensuring that all the students have equal opportunities to choose their school subjects with the resources devoted for the subjects, giving students equal opportunities to borrow resources like textbooks for home work, giving students equal opportunities to nurture their talents by allowing every student to use the school sporting facilities and the school farm scoring highly against distributing school resources without regard for students' demographic and socio-economic background, giving more resources to their struggling students in areas where they are lacking and Teachers with more experience and credentials are distributed equally among classes within the school, scoring moderate.

Findings from research question one is in line with the finding of a study conducted by Packard (2008), on Leadership and Performance in Human Services Organizations. The study found that material resources were effectively distributed. In the same vein, the finding also disagreed with same study as he equally found out that human resources were not equitably distributed in the human service organization. This may be as a result of favoritism and selfishness or the fact that some schools may lobby to have more staff than others while others lag behind for reasons only known to them. The finding also disagreed with the finding of a study carried out by Afolabi, Oyewusi and Ajayi (2008), on Allocation and Management of Resources for the Sustenance of Free Qualitative Secondary Education in Ondo State, Nigeria. Their study found that resources were not equitably distributed across the public secondary schools in Ondo State. This difference may be attributed to difference in time or geographical location.

Furthermore, the finding of research question one is in line with the finding of a study carried out by Clayton and LaBatt (2019), in USA on Balancing the Role of the Principalship: Creating and Sustaining Equity and Excellence. Their study found that these three principals demonstrated democratic ethical leadership practices influenced by their personal and professional experiences.

Findings from research question two revealed that, the respondents significantly agreed to a high extent that; principal have the ability of

ensuring that all subjects are being taught by qualified teachers, they have the ability to attract and retain best teachers in the school, infusing relevant staff professional development opportunities and teachers productivity to help students, ensuring that assigning of teachers to classes is based on their area of expertise, and always make effort to replace staff in case of leave, transfer, resignation and retirement against moderately agreed on whether principal usually foster a more collaborative school culture, usually match experience teachers with less experience teachers in the school, develop formal and informal partnerships with other school Principals to keep tract of high-quality or experience teachers, making provision for ventilation system, toilets, and photocopy machines for a comfortable physical working condition of teachers, and employ P.T.A staff in the school based on objective laid down procedures rather than favoritism.

This finding of research question two is in line with the finding of a study conducted by Perez (2022), on the relationship between a principal's practice in resource allocation and how it promotes a school's collaborative culture in New York City, USA. His study found that significant positive relationships were found in the re-directing of monies for reduction of class size, allocating monies for professional development over the summer, and the solicitation of input from all teachers and staff when planning the school budget. The finding disagreed with the finding of a study carried out by Chidi and Ndidi (2017), on investigation to analyze resource management strategies adopted by principals for secondary schools' improvement in Enugu State, Nigeria. They found out that many material and human resource management strategies have not been adequately adopted by principals for secondary schools improvements in Enugu State and that secondary school principals in Enugu state have not adequately adopted human resource management strategies such as organsing in-service training for staff professional development, equipping staff offices, giving prizes to staff for excellent performance, provision of counseling services and sanitary facilities for staff well-being.

The finding of research question two also agreed with the finding of a study carried out by Miltiadis, Ioanna, Georgios, Grigorious and Vassilis (2020), on The School Principal's Role as a Leader in Teachers' Professional Development: The Case of Public Secondary Education in Athens to improve the learning process and school quality. The evidence from this study confirmed a direct impact of the school principal's training on teachers' professional development. The finding also agreed with the finding of a study

conducted by Balyera *et al.* (2015), in Istanbul, Turkey on Principals' Roles in Establishing Collaborative Professional Learning Communities at Schools. Results revealed that school principals have significant roles establishing professional learning communities.

Conclusion

Principals in Kebbi State secondary schools demonstrate a divided leadership capacity. They are effectively proficient in administrative and logistical functions related to resource and staff management. However, they exhibit significant limitations in the strategic and formative leadership practices essential for fostering an equitable and collaborative professional environment. This disparity between operational competence and strategic inadequacy ultimately constrains the full potential for enhancing teacher productivity through equitable resource distribution.

Recommendations

Based on the findings, the following recommendations are made:

- I. The State Ministry of Education should implement mandatory, continuous professional development for principals focused on strategic equity leadership, specifically training them in data-driven resource allocation to support struggling students and in methods for the equitable distribution of experienced teaching staff across classes.
- II. School Principals should proactively develop and implement formal mentorship programs that pair experienced teachers with less-experienced colleagues and establish partnerships with other schools to share best practices and resources.
- III. The state government should allocate specific funds and support for improving the physical working environment for teachers, prioritizing the provision of essential amenities such as functional ventilation, clean toilets, and photocopying facilities to boost morale and productivity.

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Integrating the Skills Edifice of Curriculum into Almajiri Education in 21st Century Northern Nigeria

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Abstract

This paper attempts an in-depth study as well as critical analysis of Almajiri education system in the 21st century Northern Nigeria, with a particular emphasis upon areas in which its curriculum needs improvements and innovations. It equally underscored the governments' efforts at integrating Almajiri education in Universal Basic Education program and the causative organisms for the failure of government's integration program. And therefore the predicaments of Almajiri seem to have been lingering year-by-year, partly due to propound deficiency of vocational / entrepreneurship development skills within the framework of Almajiri education. Related literature was reviewed. Document analysis method was adopted for the study. The findings revealed that integration program enhances efficiency of Almajiri education system by striking balance among the acquisition of Qur'anic knowledge, moral development and accomplishing economic self-reliance / employability. And the researcher suggested that Federal, state and the local governments in Nigerian should look into the need to integrate the entrepreneurship / vocational skills enshrined in National Policy on Education in the curriculum of Almajiri School as response to the vocational challenges which strangle the program from contributing to Nigeria's national unity and national development.

Keywords: Integration, Skills, curriculum, Almajiri Education, 21st Century

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Introduction

The Almajiri education is as old as Islamic education system in Africa. History of Islamic education in Northern Nigeria could be traced back to second half of the 11th century, when Islamic religion was introduced in the region through the activities of Arab traders. During that material time, there emerged hundreds of Qur'anic schools (Tsangaya) which accommodated thousands of students (Almajiris) from across Hausaland purposely to learn Qur'anic sciences. Having catered for the socio – economic and political needs of the people via the production of books, ideas and scholars of high repute who served Hausa land at distinctive capacities, the system benefited from the support of all stakeholders. Up till the advent of colonial masters, that was the status and position of Almajiri education in Hausaland.

By 1906, when the entire of Hausaland fell under the control of British colonial masters, Qur'anic education experienced an unprecedented change regarding its position. By 1909, western education became successfully introduced in Northern Protectorate, following the success in Nasarawa experiment by Hans Vischer under the auspices of the Church Missionary Society (CMS). hence, the stakeholders were compelled by colonial authorities to value as well as support western education at the expense of Qur'anic education. And since then, Qur'anic education has been relegated to background.

Since the pre – colonial era, the Almajiri education had been the only machinery utilized for effective inculcation of positive moral virtues and values amongst the generation of youths in Hausaland. And it has continued to play a vital part towards the overall moral development by equipping the youths with such morals as; “trustworthiness, open-mindedness, tolerance, courage, activeness, fellow-feeling, compassion, politeness, fidelity, perseverance, co-operation, interdependence, integrity, diligence, obedience and magnanimity (Okam, 2012) which desperately desired for the development of prospective citizens who will become the building – blocks of a strong nation.

However, it is very sad that the trending in Almajiri education system is being accompanied by some challenges which border on the lack of certification that prepares Almajiri for job opportunities in the public as well as private sectors and admission for further studies in the tertiary institutions including

universities; lack of vocational skills that enable the Almajiris accomplish self - reliance through self – employment; child labor and abuse; involvement of some Almagiris in terrorist activities; street begging and hawking which raise serious concerns from the government, researchers and writer about it. This chapter therefore, aims at uncovering the vitalities of integrating the vocational skills perspectives implicit in the curriculum that operates within the framework of apprenticeship system in Nigerian education, towards improving the Almajiri education system so as to prepare its proceeds for self – reliance via self – employment. This will surely make the Almajiris functionally contributing to the economic development of Nigeria.

Literature Review

A review of related literature was carried out on the concepts of Almajiri, curriculum, integration and curriculum integration.

Almajiri and Almajiri Education

Many people in Nigeria see the word ‘Almajiri’ as a person who goes in tarter rags, hawks along the street and begs for means of livelihood by the road sides or in religious places. As a child born in a muslim Hausa state of Northern Nigeria who puts on rags and survives on begging. The Muslim Hausa people who did not attend western schools and roam about the city streets (Olaniran, 2018) and religious places begging for a living. These definitions represent a portrait of popular but erroneous and sentimental conception of the concept being held by some people for the purpose of degrading as well as debasing the personality of some religious and ethnic groups.

The term ‘Almajiri’ as Shittu & Olaofe (2015) said is a derivative of the Arabic terminology ‘*al-Muhajir*’ (the traveller or migrant), meaning someone who migrates for a precious purpose. The word ‘Almajiri’ according to Zakir et al (2014), connotes a student who leaves his parent for Qur’anic education. They come mostly from rural areas to urban centres for the purpose of acquiring Qur’anic education. Shittu and Olaofe (2015) conceive that in Northern Nigeria, *Al-Majiri* is particularly used to refer to school-age children who leave the comfort of their homes and parental care to seek knowledge in nearby towns and cities. Goodluck & Juliana (2014) opined that children sent from their homes and entrusted into the care of Islamic teachers to learn the Islamic studies. Whereas Olaniran (2018) posits that the children of nomadic population in Nigeria are referred to ‘almajiris’. The Almajiris consist of

children of the mobile fishermen, pastoral nomads, and farmers, among others. Accessing formal education is a problem for almajiris because they must move with their parents wherever they go in search of greener pastures for their cattle (Olaniran, 2018). This definition conveys a package of erroneous, sentimental as well as derogative conception which emanates from the author's shallow or superficial knowledge of the Almajiri phenomenon as it operates in sub-Saharan Africa. It is vital to note that this definition narrowed down the meaning of 'Almajiri' to those children who migrate to urban centres purposely to acquire Qur'anic knowledge. This is because there are a number of children who study in Tsangaya / Almajiri schools and do not migrate from anywhere, they are born as well as brought up within the hosts community of the Tsangaya school. And this situation is prevalent in about 57% of 'Almajiri' / Tsangaya schools in Northern Nigeria. Similarly, there are lot of adolescents and elderly people that storm the restaurants, motor parks, religious places, roadside etc, begging to earn livelihood and the aforementioned definition did not capture this groups of beggars. Perhaps, Zakir's conception of 'Almajiri' was guided by the lateral meaning of the word 'Almuhajir' which simply denotes physical migration of a people from one place to another.

The word 'Almajiri' simply refers to as the students of Tsangaya school. It is true that Almajiri migrates for Qur'anic epistemological motive. But the migration could be understood from two dimensions, first, the physical and second, the spiritual migrations. While physical migration refers to as the movement of an individual from rural to urban areas or vice versa, in a search of Qur'anic knowledge. This sort of migration, in Islam, is surrounded by the following conditions, namely; relatively enough fund to cater for Almajiris' numerous needs during their stay at Tsangaya school; child's gender should be masculine not the feminine; and lastly, age of the children should be taken into cognizance in order to be able to carry out the academic tasks in the Tsangaya. Secondly, the spiritual migration, according to Gada (2010) entails movement of the person's minds from his personal wims and caprices to the obedience of dictates of Allah the Almighty amongst which, the search of Islamic / Qur'anic knowledge fall in. Therefore, the concept of 'Almajiri' refers to as the student of Tsangaya schools who migrate from all his enjoyment to what Allah wants (acquisition of Qur'anic knowledge).

Curriculum

The concept of curriculum is defined by scholars narrowly, as subjects or content(s) which learners are taught in schools. It is broadly viewed, as experiences that individuals are exposed to during a learning exercise (Ornstien & Hankins, 2018). McLachlan, Fler, & Edwards, (2010) agreed with Scott's (2008), conception that a curriculum may imply a "system, as in a national curriculum; an institution, as in a school curriculum; or even to an individual school, as in the school geography curriculum require for full participation in society". But in another conception by subscribed to Grundy's (1987) view that a curriculum as:

a way of organizing educational practices based on three rationales: (i) product where the focus is on reproducing knowledge for a defined outcome, (ii) the practice which emphasizes the development of understanding in order to make judgments and apply knowledge, and (iii) praxis of instruction which focuses on learners' reflection of learning on their real live activities.

The first conception of curriculum as 'product' aligns with Ornstein's (2016) 'prescriptive' definitions that signifies what "ought" to happen, and it more often than not takes the form of a plan, an intended program, or some kind of expert opinion about what needs to take place in the course of study. Scholars like Okam (2012) subscribes that curriculum is an all-embracing concept which implies a subject matter, content area, a discipline being rendered by an authority or teacher within the framework of classroom in a school system, in order to achieve predetermined objectives. Also, Okeke (1978) viewed curriculum as a series of planned and / or unplanned learning activities which a child is exposed to in the course of his development, the aim of which is to make him develop fully his potentials so as to function effectively in the community.

The second conception of curriculum as 'practice' reveals the postmodern viewpoint of the subject matter, emphasizes on the learners development of understanding in order to make judgments and apply knowledge. This conception exposes the significance of using activity-based methods of curriculum development, materials and resources that combine into a paradigm that allows the learners to participate in hands-on instructional activities mainly to uncover knowledge and understanding.

Furthermore, the third layer of this conception is, curriculum as the ‘praxis’ of instruction, transforms learning into an instructional template that allows the learners to collaboratively interact, work and brainstorm, discuss on learning experiences purposely to foster the learners’ reflection of learning on the real live activities

Therefore, designing, implementing and evaluating curriculum program should aim at help individuals to uncover and develop their potentials via a positive inculcation of the knowledge forms, namely; knowing and recall of concepts, ideas, principles etc, feelings, emotions and attitudes, and skills so as to become functionally contributing members of their societies. This paper represents an attempt towards proffering certain apt modalities for integrating the vocational / entrepreneurship skills implicit in the curriculum of Nigerian education as enshrined in the National Policy on Education (2013) being an appropriate for equipping the Almajiri with specific employability skills. This will surely help the Almajiri not only achieve self – reliance via self – employment but also develop in them a healthy attitude to work.

Curriculum of Almajiri / Program

The Almajiri system is basically a literary education that aims at producing people who are learned in Arabic language, shari’ah law and theology. Qu’ran has been the core-curriculum of this system of education, (Goodluck & Juliana, 2014) this implies that learning experiences of Almajiri school are sourced from the Holy Qur’an and the sunnah of the Prophet (Prophetic traditions). The curriculum has provided each learning level with apt learning experiences that will enable Almajiris with accomplish a reasonable degree of development in terms of cognitive and affective components. The major disciplines derived from the Holy Qur’an for Almajiri instruction in school include the following; (1) Huruf, (2) Tajweed, (3) Recitation and Memorization of Qur’an, and (4) Tafseer. Similarly, Fafunwa had categorize instructional activities in Almajiri school into three (3) levels, namely; (1) the primary level, (2) the secondary level and (3) the post – secondary level (Fafunwa, 1998).

The primary compartment starts as early as 3 years, instructional engagements involve rote learning and choral recitation of the verses of the 1st two chapters of the Qur’an and then elementary literary practice involving reading and writing of Arabic letters of alphabet (Fafunwa, 1998). While at secondary

level, learners are introduced to more varied items of the Hadith text, and begin a more meaningful study of the Holy Quran (Fafunwa, 1998). However, instructions are conducted through the utilization of rote and repetition methods (Fafunwa, 1998). The post - secondary students are exposed to other subjects such as Arabic language, syntax, shari'ah, theology, jurisprudence etc (Fafunwa, 1998).

Furthermore, methodology of instruction in Almajiri schools was the 'individualized method' of learning that allows every learner to learn at his own rate. Whereas the organization and administration of school were decided by the Islamic scholar spearheading its activities.

Curriculum Integration

Integration simply denotes combining two or more things, concepts or ideas together. The curriculum integration is a jargon within the parlance of curriculum organization. Curricular program comprised of knowledge forms which organized to reflect a particular pattern that can best help design the education system towards addressing various societal problems and provide adequately for its multifaceted needs. The variety of patterns in which the curriculum is designed include the following: the discrete subject, the correlation, the broad field and the integration designs (Ellis, 2013).

The concept of integration in the realm of curriculum design simply means the pattern of combining concepts, principles, ideas, laws, phenomena and theories from two or more distinct discrete subject areas into an integrated curriculum (Audu, 2011) that aims at acquainting learners with variegated cognitive structures, attitudes, emotions and feelings, and skills that will help them to leave and work in distinctive circumstances.

Integrated curriculum is described as one that connects different areas of study by cutting across subjects – matter lines and emphasizing unifying concepts (New Zealand Council for Educational Research, 2019).

Methodology

Document analysis method was adopted for this study. The researcher studied as well as reviewed appropriate journal articles, book chapters, conference papers, magazines and newspapers in order to form solid foundation for the discourse.

Integration of Western Education into Almajiri System in Nigeria

It is undisputed fact that the Department for International Development (DFID, 2000) established strong relationship between levels of education of citizens and economic growth of a nation (Olaniran, 2018). It notes education as a fundamental tool that enables less – privileged individuals to develop skills, enhance productivity and provides essential underpinnings for economic growth. In line with aforementioned, the concept of all-inclusive education continues to gather momentum in the third world nations. All-inclusive education has expanded as well as metamorphosed into a human right framework that demands access to, and equity in, education or learning for all, irrespective of status, gender, and geographical location (Olaniran, 2018).

It is in view of foregoing exposition that Federal government of Nigeria under the Universal Basic Education Act of 2004 proclaimed that every government in Nigeria shall provide free, compulsory and universal basic education for every child of primary and junior secondary school age’ (Federal Ministry of Education, 2011). Attaining this, as Yunusa, (2013) opines that the Act provides that every parent shall ensure that his or her child or ward attains and completes primary school education and junior secondary school education. The scope of the implementation of the program according to Federal Ministry of Education (2011) will centre upon education of special groups including the migrants, the girl – child and women, Almajiri street children and disabled groups. This mandate has encouraged the Universal Basic Education Commission to envisage ‘main streaming and promoting a dynamic Almajiri Education model that will ensure gradual integration of the Almajiri into Universal Basic Education program’ (Federal Ministry of Education, 2011). For the first time, Federal government designed specialized education program that seek to provide Almajiri with the necessary knowledge and skills to function and contribute positively towards socio – economic development of the society and the nation (Federal Ministry of Education, 2011). And some eight objectives formulated to guide the implementation of the program, in the following areas to:

- I. Design and develop appropriate Almajiri school,
- II. Identify the traditional Qura’nic schools for integration,

- III. Fund the model schools,
- IV. Harmonize the curricular for the schools,
- V. Issue textbooks and learning materials for core subjects,
- VI. Mobilize the stakeholders for sensitization of the program,
- VII. Establish management committees at various levels of government,
- VIII. Interface with development partners, organized private sector, non – governmental agencies and community - based organizations, and
- IX. Recruit teachers, capacity – building for teachers and managers.

A panoramic look at the above objectives translates Federal government's beautiful intention towards improving socio – economic conditions of Almajiri, through the means of mainstreaming Almajiri education into Universal Basic Education program. This culminated in establishment of two Tsangaya Model Science Primary schools; one cited in Sokoto and the other in Katsina states of northern Nigeria, in the year 2012.

However, it is indeed sad to announce that despite its lofty objectives, integration of Almajiri integration was not a success due to the following reasons:

- I. Neglect of the needs, interests and values of Almajiri and his society,
- II. Superficial study of the needs of the Almajiri system of education,
- III. Laxity of the history of Almajiri system in Northern Nigeria,
- IV. Poor sensitization of the stakeholders in Almajiri education,
- V. Corruption / misappropriation of the fund and other inputs,
- VI. Improper planning of the integration program.

It will be vital if the foregoing are considered in some details below:

First of all, Almajiri integration program was designed, planned as well as implemented without giving due cognizance to Almajiri needs, interests and values. And there has not been disagreement amongst all curriculum theorists that any attempt towards curriculum designing, improving and or innovating curriculum program, like Almajiri integration, must capture and rhyme with the needs, interests and values of the target learners and the society.

In fact, Almajiri needs, interests and values as they manifest, revolve round two principal activities, namely; Qur'anic / Islamic epistemology, while, the second is petty economic gainful economic activities. And majority of them are neither interested in western education nor do they value it. In a nut shell, all stakeholders in Almajiri system of education developed and sustained phobia to western schooling. Therefore, how can the program's integration into western schooling be successful? It cannot.

Furthermore, Almajiri education system had for more than 500 years back, been serving the motives it is meant for in Northern Nigeria, in terms of imparting students with cognitive structures implicit in the Holy Qur'an, purposely to enable learners accomplish a higher level of moral standing. This will facilitate their metamorphoses into prospective citizens. The need of Almajiri education system as observed should be emphasized in the integration process and then innovate structured 'apprenticeship' program that will acquaint and equip Almajiri with an apt vocational / employability skills with a sole view to enhancing the economic status and improve their economic contributions to the development of the Nigerian nation.

Similarly, Almajiri integration program failed at the planning stage due to government laxity of history of the system in Northern part of the country. The Federal government did not pay desired attention to the history of Almajiri system when planning for integration program. And this is partly why instead of accomplishing objectives that prompt the programme, it fall victim of the same guilt as the Christian missionaries in northern Nigeria during the colonial epoch.

Historically, the attempts by various missionary societies to introduce western education in the then Northern Protectorate, had faced a stiff resistance from the people who saw the missionaries as agents of education and thereby missionary schools were established primarily to convert students to Christian faith, the northern Muslims had come to see western education as a

deliberately planned and calculated action towards destroying their Islamic faith. Therefore, integrating Almajiri education is a volatile issue which requires a proper homework for its success.

In 1898, Bishop Tugwel of the Church Missionary Society based on Lokoja obtained Lugard's permission to penetrate into Hausa land. Lugard also allowed the Sudan Interior Mission. The Church Missionary Society established a school called 'home school' in Zaria. The C.M.S attempted the same in Kano, but were driven out by the Emir of Kano (Olaniran, 2018). In 1902, the Roman Catholic Mission (R.C.M) made several attempts to open stations and school at Ibi and Basa (present day Taraba state), but finally withdrew in 1905 without much impact.

The Sudan Interior Mission established farms at Patel, Wushishi and Bida, but their inclusion of religious instruction in their curriculum made them come to bad terms with Lugard (Olaniran, 2018). The C.M.S opened school for mallams at Bida which was to be secular so as to train court officials, but with carefully – chosen texts based on Christianity as a curriculum. The school soon disintegrated as the mallams discovered the religious motives of the mission.

In 1907, Dr. W. Miller of the Church Missionary Society established two schools, one for boys and the other for mallams at Zaria. Both schools failed to take off because of Miller's strong religious convictions that the students must be converted to Christianity (Olaniran, 2018).

Until in 1909, when Hans Vischer of the C.M.S studied the immediate needs of the local population, introduction of western education became an uphill task to Christian Missions in Northern Nigeria. The federal government needed to lay hand on such historical literature at the planning stage of Almajiri integration programme so that it becomes a success.

Another vital factor to the failure of Almajiri integration in Nigeria is the poor sensitization of the stakeholders in Almajiri system. A rigorous sensitization campaign of all stakeholders was intrinsic in the Almajiri integration programme so as to create ample awareness of the programme that will surely culminate in its success. However, hardly if a campaign of this nature was carried in any part of Northern Nigeria.

Finally, corruption and misappropriation of fund was yet another reason for the woeful failure of the Almajiri integration programme in Northern Nigeria. A lot of fund allotted for the implementation of the programme were misappropriated and diverted to personal expenditure of some of the unpatriotic officials. And this adversely affected the overall success of the programme.

Skills Edifice of Curriculum and Its Integration into Almajiri Education

The curriculum being operated within the framework of Nigerian education system is an embodiment of numerous knowledge forms that appeal to distinctive human capabilities, namely; the cognitive, the affective and the psychomotor edifices. The psychomotor / skills component of Nigerian education programme concerns itself with inculcating generation of youths with vocational skills under the auspices of entrepreneurship / apprenticeship programmes. This is purposely aimed at ascertaining youths' achievement of self – reliance through self – employment.

A list of various vocational / entrepreneurship development skills is enshrined in National Policy on Education (2013). Not only that but also mandated each Nigerian youth to acquire, develop as well as achieving a reasonable mastery level in at least one of the following vocational / entrepreneurship skills of need and interest under the guidance of school.

- I. Auto Body Repair and Spray Painting,
- II. Auto Electrical Work,
- III. Auto Mechanical Work,
- IV. Auto Parts Merchandise,
- V. Air Condition and Refrigerator Repairs,
- VI. Welding and Fabrication Engineering Craft Practice,
- VII. Electrical Installation and Maintenance Work,
- VIII. Radio, Television and Electronic Servicing,
- IX. Block Laying, Brick Laying and Concrete Work,

- X. Painting and Decorating,
- XI. Plumbing and Pipefitting,
- XII. Machine Woodworking,
- XIII. Carpentry and Joinery,
- XIV. Furniture Making,
- XV. Upholstery,
- XVI. Catering Craft Practice,
- XVII. Germen Making,
- XVIII. Clothing and Textile,
- XIX. Dyeing and Bleaching,
- XX. Painting Craft Practice,
- XXI. Cosmetology,
- XXII. Photography,
- XXIII. Mining,
- XXIV. Tourism,
- XXV. Leather Goods Manufacturing and Repair,
- XXVI. Stenography,
- XXVII. Data Processing,
- XXVIII. Store Keeping,
- XXIX. Book Keeping,
- XXX. GSM Mentainance and Repair,
- XXXI. Animal Husbandry,

- XXXII. Poultry,
- XXXIII. Fishery,
- XXXIV. Marketing,
- XXXV. Salesmanship.

Moreover, since the Almajiri form a parcel of Nigerian youths, they should equally be enjoined to acquire, develop and master at least one of the aforementioned vocational / entrepreneurship development skills of need and interest, under the auspices of a structured apprenticeship programme that will be guided as well as coordinated by the Malams (Head of the Almajiri schools), the government and the private partners.

In this apprenticeship programme, the government would partner with vocational schools / centres that are within the reach of a group of Almajiri schools where the Almajiri will receive instructions in his chosen vocation.

The Almajiri school would prepare and compile a list of its Almajiri population and ensure that each of them indicates and register for a vocation of his choice. And submit the same to vocational school / centres for further action.

An arrangement would be planned by Almajiri schools on when the Almajiri apprentice children would be attending the vocational centres for instruction. And the Almajiri schools should be left to decide on this aspect because it needs to be planned in a manner that would not interfere with or disrupt Almajiri academic activities. The Almajiri needs to attend the vocational centres for apprenticeship training, at least 48 hours every week.

Findings

Based on the study, the following findings were revealed:

That the integration program enhances efficiency of Almajiri education system by striking balance among the acquisition of Qur'anic knowledge, moral development and accomplishing economic self-reliance / employability.

That with integration program Almajiri will have been equipped with self-reliance and employability skills that transform him into job-creator in addition to memorization of the Holy Qur'an.

That integration program offers Almajiri new socio-economic status in the society, the Almajiri lives on begging in the society but now engaged to work as petty trader or service provider in the community. This will have really scaled up the worth and value of Almajiri.

That integration will have program impact on Nigeria's growth domestic product (GDP), when the number of Almajiris are focused on small scale production of good and services in the society, then it will impact on the private sector economy which will have incremental effect on the nation's GDP.

That integration program will improve the security condition of the nation, as the unemployed Almajiri will be given a job to hang on for survival. And this truncates the mercenary supplies for terrorist groups operating in Nigeria.

Conclusion

The Islamic epistemological activities had been a component of the peoples' culture since the advent of Islamic religion in Northern Nigeria. And for more than 500 years back, the Qur'anic education system provided not only for the yearnings of the Muslim population but also contributed its quota to the production of effective Nigerian citizens through inculcating the youths positively with the moral virtues and values implicit in Holy Qur'an. However, the rising security challenges that pervaded the region and changes in the economy with their consequential repercussions upon the population, necessitated government intervention into the system with a view to ameliorating the predicaments surrounding Almajiri education. Though almost all efforts failed to make much impact, it is hoped that integration of the skills component of Nigerian education system, in a manner that does not interfere with Almajiri schools' academic engagements. This will play a vital part towards the empowerment of Almajiri children to accomplish self – reliance through self – employment, and enhance their economic status that in the long run results in boosting their contributions to national development.

Suggestions

Based on the foregoing paragraphs the authors suggested that:

- I. The Federal, state and the local governments in Nigerian should look into the need to integrate the entrepreneurship / vocational skills enshrined in National Policy on Education in the curriculum of Almajiri School as response to the vocational challenges which strangulate the program from contributing to Nigeria's national unity and national development.
- II. The relevant non-governmental organizations (NGOs) should provide collaboration support with skill acquisition centres across Northern Nigeria for this integration program to be achieved.
- III. There is need for adequately sensitize the Parents, Almajiri school scholar on the integration program, its direction and focus in order to avoid misperception.
- IV. The Universal Basic Education Commission (UBEC) should work out modalities of government – NGOS – Almajiri school collabotion in order to ascertain uniformity in the integration program across the country.

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Integrating Artificial Intelligence in Special Needs Education for Effective Early Childhood Development

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Abstract

The integration of Artificial Intelligence (AI) into education is transforming teaching and learning processes globally by enhancing personalization, accessibility, and learner engagement. In special needs education, particularly at the early childhood level, AI offers significant opportunities to improve learning outcomes and developmental support. Children with special needs, such as those with autism, attention disorders, speech and language difficulties, and developmental delays, often require individualized instruction and adaptive learning environments, which traditional systems may not adequately provide. AI-driven technologies, including machine learning, natural language processing, and speech recognition, enable the development of intelligent systems that adapt to the unique learning pace and needs of each child. These technologies support personalized instruction, real-time feedback, and targeted interventions, thereby improving cognitive, communication, and behavioral development. AI tools also enhance speech and language skills through interactive platforms. In addition, AI supports social and emotional development through virtual environments, intelligent tutoring systems, and assistive technologies, allowing children to practice social interaction in structured settings. Despite its benefits, AI integration presents challenges such as data privacy concerns, limited access, ethical issues, and the need for teacher training. This study highlights the importance of proper implementation and recommends increased investment in infrastructure, continuous teacher training, equitable access to technology, and the development of clear ethical guidelines. These measures are essential to ensure that AI is effectively integrated to support inclusive and quality early childhood development for all learners.

Keywords: Integration, Artificial Intelligence, Special Needs, Early Childhood Development, teaching and learning

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Introduction

Early childhood is widely recognized as a critical period in human development, during which rapid growth occurs in the brain, laying the groundwork for cognitive, emotional, social, and behavioural functioning throughout life (Shonkoff & Phillips, 2000). The experiences and educational interventions provided during this period have profound and long-lasting effects, particularly for children with special needs. Children with developmental challenges, such as autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), dyslexia, speech and language impairments, intellectual disabilities, or sensory processing disorders, often require more intensive and specialized forms of support to achieve developmental milestones (Guralnick, 2011). Without timely and appropriate interventions, these children may struggle to acquire foundational skills necessary for academic and social success, potentially leading to long-term exclusion or underachievement.

Traditional educational models, while effective for many children, frequently fall short when applied to learners with atypical developmental trajectories. Classrooms are typically structured around standardized curricula and instructional methods, which may not align with the varied learning profiles, processing speeds, or sensory needs of children with special needs (Florian, 2014). Teachers may lack the training or resources necessary to modify content or pace in real-time, and individualized education plans (IEPs), though helpful, are often limited by logistical constraints. Moreover, in regions with teacher shortages or underfunded special education programs, providing high-quality, consistent, and individualized instruction to every learner becomes even more challenging.

In response to these systemic limitations, artificial intelligence (AI) has emerged as a transformative force in the field of education. AI refers to the development of computer systems capable of performing tasks that typically require human intelligence, including learning, reasoning, problem-solving, perception, and language understanding (Russell & Norvig, 2020). When applied to educational contexts, AI technologies can analyse large datasets, detect learning patterns, and adapt instructional content to suit the unique needs of each learner (Luckin et al., 2016). This ability to deliver real-time, data-driven, and highly personalized learning experiences makes AI

particularly valuable for supporting children with special needs, whose educational requirements are often nuanced and fluctuating.

In the context of early childhood development, AI-powered tools can serve as both supplements and enhancers of traditional pedagogy. For example, intelligent tutoring systems (ITS) can adjust difficulty levels based on a child's performance, ensuring that learning remains appropriately challenging without becoming frustrating (VanLehn, 2011). Speech recognition and natural language processing (NLP) technologies can assist children with communication difficulties by enabling alternative or augmented modes of expression (Kuriakose & Lahiri, 2017). Similarly, AI-driven social robots and virtual agents can model appropriate social behaviour and offer consistent feedback in emotionally safe environments, which can be especially beneficial for children with autism (Diehl et al., 2014).

Furthermore, AI has the potential to support educators by automating administrative tasks, identifying early signs of developmental delay through predictive analytics, and providing data-driven insights into student progress. These capabilities not only increase efficiency but also allow teachers to focus more on instructional delivery and emotional support. In underserved or resource-limited settings, AI can help bridge the gap by making specialized support more accessible and scalable (Holmes et al., 2021).

While the integration of AI in early childhood special education is still evolving, early research and pilot programs suggest promising outcomes in areas such as language acquisition, behaviour regulation, social interaction, and adaptive learning. However, the deployment of AI in this sensitive domain must be approached thoughtfully, with careful consideration of ethical implications, data privacy, equity of access, and the need for teacher training (Williamson & Eynon, 2020). The goal should not be to replace educators, but rather to augment their ability to meet the diverse needs of all learners.

This paper investigates how artificial intelligence can enhance early childhood development by offering customized support to learners with special needs and fostering inclusive learning environments. Through an analysis of existing applications, benefits, and challenges, the paper aims to provide educators, policymakers, and researchers with a comprehensive understanding of how AI can be leveraged to promote equity, accessibility, and improved outcomes in special needs education.

Applications of Artificial Intelligence in Special Needs Education for Effective Early Childhood Development

1. Personalized Learning

One of the most significant contributions of Artificial Intelligence (AI) to special needs education is its ability to support personalized learning. In early childhood education, learners develop at different rates, and this variation is more pronounced among children with special needs. Integrating AI into educational settings allows for the development of adaptive learning systems that respond to each child's unique learning pace, strengths, and challenges.

AI-powered platforms analyse learners' interactions, performance patterns, and responses in real time. Based on this data, the system adjusts instructional content, level of difficulty, and delivery methods to suit individual learners. This is particularly beneficial for children with learning disabilities or attention-related challenges, as it moves beyond the limitations of traditional teaching methods.

In addition, AI tools provide immediate feedback, suggest alternative explanations, and present content through multiple sensory formats such as audio, visuals, and interactive activities. These features enhance understanding, improve retention, and increase engagement. As noted by Holmes et al. (2021), AI-driven personalized learning systems can significantly improve learning outcomes by tailoring instruction to individual needs.

2. Speech and Language Development

Speech and language development is a critical component of early childhood education, especially for children with special needs who may experience communication difficulties. The integration of AI has led to the development of tools that support language acquisition in interactive and engaging ways.

Technologies such as speech recognition and natural language processing enable AI systems to assist learners in practicing pronunciation, vocabulary, and sentence construction. Tools like speech-to-text and text-to-speech applications make communication more accessible and provide opportunities for both expressive and receptive language development.

AI-based applications can also simulate real conversations, provide instant corrections, and adjust tasks according to the learner's progress. These tools are particularly effective for children with speech delays, stuttering, apraxia, or developmental language disorders (Kuriakose & Lahiri, 2017). The use of gamified environments and animated interfaces further enhances engagement and reduces anxiety.

Through continuous interaction and feedback, AI supports the development of communication skills, which are essential for both academic success and social participation.

3. Social Skills Development

The development of social and emotional skills is essential in early childhood, yet many learners with special needs, especially those with autism spectrum disorder (ASD), experience challenges in this area. AI integration offers innovative approaches to support social development through structured and interactive environments.

AI-powered tools such as virtual reality (VR), interactive simulations, and socially assistive robots can model real-life social situations. These systems help learners practice skills such as recognizing emotions, interpreting facial expressions, and responding appropriately in social contexts.

These environments are safe and controlled, allowing repeated practice without fear of embarrassment. According to Diehl et al. (2014), technology-based interventions can significantly improve social functioning in children with ASD.

Furthermore, AI systems can monitor learner progress and provide data-driven insights to educators and therapists, enabling more targeted interventions. This enhances confidence, improves interaction, and supports emotional development.

4. Assistive Technology and Accessibility

AI has greatly improved the effectiveness of assistive technologies used in special needs education. These technologies help learners overcome physical, sensory, or cognitive barriers to learning.

Examples include AI-powered screen readers for visually impaired learners, hearing support systems for those with hearing impairments, and predictive text tools for learners with writing difficulties. Computer vision technologies can also assist learners in recognizing objects, reading text, or navigating their environment.

Such tools increase independence and allow learners to participate more actively in classroom activities. According to Luckin et al. (2016), AI-enhanced assistive technologies play a key role in promoting inclusion and accessibility in education.

5. Assessment and Progress Monitoring

AI integration has transformed how learners with special needs are assessed. Traditional assessment methods may not accurately reflect the abilities of these learners. However, AI enables continuous and more accurate evaluation.

AI systems can track performance over time, analyse learning patterns, and identify strengths and areas of difficulty. This allows for early identification of learning challenges and timely intervention.

Teachers and specialists can use this data to adjust teaching strategies and provide individualized support. This data-driven approach improves decision-making and enhances learning outcomes (Holmes et al., 2021).

6. Behaviour Management and Support

Managing behaviour is an important aspect of special needs education, especially for learners with emotional and behavioural disorders. AI can assist in monitoring and managing behaviour through intelligent systems.

For example, AI tools can track patterns in behaviour, identify triggers for negative actions, and suggest appropriate interventions. Some systems use wearable devices or classroom sensors to monitor attention levels and emotional states.

These insights help teachers respond more effectively and create supportive learning environments. AI-based behaviour management systems also promote positive behaviour through reinforcement and feedback.

The integration of Artificial Intelligence in special needs education provides innovative solutions that enhance early childhood development. From personalized learning and communication support to social skills training, assistive technology, assessment, and behaviour management, AI offers a comprehensive approach to addressing the diverse needs of learners.

When properly implemented, AI can create inclusive, adaptive, and supportive learning environments that enable children with special needs to achieve their full potential.

Impact of Artificial Intelligence on Special Needs Education in Early Childhood

The integration of Artificial Intelligence (AI) into special needs education has brought significant changes to how teaching and learning take place, especially in early childhood. AI technologies are transforming traditional educational practices by making learning more personalized, interactive, and accessible. For children with special needs, these innovations have a profound impact on their academic development, communication skills, social interaction, and overall learning experience.

Improved Learning Outcomes: One of the major impacts of AI in special needs education is the improvement in learning outcomes. AI-powered systems can adapt to the individual learning pace and style of each child, ensuring that lessons are neither too difficult nor too easy.

This personalized approach helps children understand concepts better and retain information more effectively. As noted by UNESCO (2024), technology-driven learning environments can enhance engagement and improve academic performance among learners with diverse needs.

Enhanced Communication Skills: AI has significantly improved communication for children with speech and language difficulties. Tools such as speech recognition systems, text-to-speech applications, and interactive language platforms provide learners with opportunities to practice and improve their communication skills.

These technologies help children express themselves more clearly and understand others better. This is especially important in early childhood, where communication plays a key role in learning and social development.

Development of Social and Emotional Skills: AI technologies, including virtual reality and interactive simulations, have a positive impact on the development of social and emotional skills. These tools allow children to practice social interactions in safe and controlled environments.

For children with conditions such as autism, AI helps them learn how to recognize emotions, respond to social cues, and interact appropriately with others. This improves their confidence and ability to build relationships.

Increased Access to Education: has made education more accessible for children with different types of disabilities. Assistive technologies powered by AI help learners overcome barriers related to vision, hearing, or physical movement. For example, screen readers, voice assistants, and adaptive learning tools enable children to participate more actively in classroom activities. This promotes inclusion and ensures that all learners have equal opportunities to learn.

Support for Teachers and Caregivers: AI does not only benefit learners; it also supports teachers and caregivers. AI systems can help teachers monitor student progress, identify learning difficulties early, and adjust teaching methods accordingly. This reduces the workload on teachers and allows them to focus more on providing individual support. It also improves decision-making by providing accurate and real-time data about learners' performance.

Increased Motivation and Engagement: AI-based learning tools often use interactive and gamified approaches that make learning more interesting and enjoyable for children. This increases learners' motivation and encourages active participation.

Children with special needs, who may easily lose interest in traditional teaching methods, benefit greatly from engaging and interactive learning environments. The impact of Artificial Intelligence on special needs education in early childhood is highly significant. It improves learning outcomes, enhances communication and social skills, increases access to education, and supports both learners and teachers. By creating more inclusive, adaptive, and

engaging learning environments, AI helps children with special needs reach their full potential and prepares them for future success.

Challenges of Integrating Artificial Intelligence in Special Needs Education

Although Artificial Intelligence (AI) has brought many benefits to special needs education, its integration also comes with several challenges. These challenges must be carefully addressed to ensure that AI is used effectively, ethically, and inclusively, especially in early childhood education.

High Cost of Technology: One major challenge is the high cost of AI technologies. Many AI tools, devices, and software require significant financial investment. Schools, especially in developing countries like Nigeria, may lack the resources to purchase and maintain these technologies. This can create inequality, where only well-funded schools have access to AI tools, while others are left behind.

Lack of Technical Skills and Training: Another challenge is the lack of proper training for teachers and caregivers. Many educators are not familiar with how to use AI tools effectively in the classroom.

Without adequate training, teachers may struggle to integrate AI into their teaching, which reduces its effectiveness. According to UNESCO (2024), teacher capacity building is essential for successful technology integration in education.

Limited Access and Digital Divide: Not all learners have equal access to digital tools and internet connectivity. This creates a digital divide between those who can benefit from AI and those who cannot. Children in rural or low-income areas may not have access to the necessary devices or stable internet, limiting the impact of AI in special needs education.

Data Privacy and Security Concerns: AI systems often collect and store large amounts of data about learners, including sensitive information related to their disabilities and learning patterns. This raises concerns about data privacy and security. If not properly managed, such data could be misused or exposed. Protecting learners' personal information is therefore very important.

Risk of Over-Reliance on Technology: Another important challenge is the risk of relying too much on AI. While technology can support learning, it

cannot replace human interaction. In early childhood education, personal interaction with teachers, caregivers, and peers is very important for emotional and social development. Over-dependence on AI may reduce these important human connections.

Lack of Infrastructure: Many schools lack the basic infrastructure needed to support AI technologies. This includes electricity, internet access, and proper devices. Without these, it becomes difficult to implement AI solutions effectively, especially in less developed areas.

Ethical and Cultural Concerns: AI systems may not always consider cultural differences or the specific needs of all learners. Some technologies may be designed based on foreign contexts, making them less suitable for local environments. There are also concerns about fairness, as some AI systems may show bias in decision-making if they are not properly designed.

While AI has the potential to greatly improve special needs education, its integration comes with several challenges such as high cost, lack of training, limited access, and ethical concerns. Addressing these challenges is essential to ensure that AI benefits all learners equally. With proper planning, investment, and policy support, these challenges can be reduced, allowing AI to be used effectively in improving early childhood development.

Recommendations

To ensure the effective integration of AI in special needs education for early childhood development, the following recommendations are suggested:

Government Investment and Support: Governments should invest in providing AI technologies, infrastructure, and funding for schools. This includes access to devices, internet connectivity, and maintenance of digital tools.

Teacher Training and Professional Development: Teachers should receive proper training on how to use AI tools effectively. Continuous professional development programs should be organized to improve their skills and confidence in using technology.

Improved Access and Inclusion: Efforts should be made to reduce the digital divide by ensuring that all learners, including those in rural and low-income areas, have access to AI-based educational tools.

Data Privacy and Ethical Guidelines: Clear policies should be developed to protect learners' data and ensure ethical use of AI. Schools and developers must prioritize data security and confidentiality.

Balanced Use of Technology: AI should be used to support teaching, not replace human interaction. Teachers and caregivers should continue to play an active role in guiding and supporting learners.

Development of Localized AI Solutions: AI tools should be designed to reflect local cultures, languages, and educational needs. This will make them more relevant and effective for learners.

Collaboration among Stakeholders: There should be strong collaboration between educators, parents, policymakers, and technology developers to ensure successful implementation of AI in education.

By properly integrating Artificial Intelligence into special needs education, it is possible to create inclusive, adaptive, and effective learning environments that support the growth and development of every child, regardless of their abilities.

Conclusion

The integration of Artificial Intelligence (AI) in special needs education has brought significant improvements to early childhood development. AI technologies have made it possible to provide personalized learning experiences, enhance communication skills, support social and emotional development, and improve access to education for children with diverse needs.

Through tools such as adaptive learning systems, speech and language applications, assistive technologies, and interactive platforms, AI has created more inclusive and supportive learning environments. These innovations allow children with special needs to learn at their own pace, build confidence, and develop essential life skills.

However, despite these benefits, challenges such as high costs, lack of infrastructure, limited access, insufficient teacher training, and concerns about

data privacy and over-reliance on technology must be addressed. For AI to be fully effective, it must be carefully integrated into the education system in a way that supports both learners and educators.

Overall, AI has the potential to transform special needs education in early childhood, but its success depends on proper implementation, ethical use, and continuous support from all stakeholders.

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Safeguarding Children's Human and Educational Rights in the Age of Artificial Intelligence: Legal and Regulatory Challenges in Nigeria

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Abstract

The rapid integration of Artificial Intelligence (AI) and digital technologies into educational systems has transformed learning environments while simultaneously raising complex legal and ethical concerns regarding the protection of children's rights. In Nigeria, where digital adoption is expanding amid evolving regulatory frameworks, the safeguarding of children's human and educational rights in the age of AI presents significant challenges. This study examines the legal and regulatory implications of AI-driven technologies on children's rights, with particular focus on privacy, data protection, access to equitable education, algorithmic bias, and online safety. Adopting a doctrinal and socio-legal approach, the paper critically analyses existing national legal instruments, including constitutional provisions, child protection laws, and data governance frameworks, alongside relevant international standards. The study identifies gaps in the current regulatory regime, particularly in addressing emerging risks associated with AI-enabled educational platforms, such as surveillance, misuse of children's data, and unequal access to digital resources. The findings reveal that while Nigeria has made progress in establishing general child rights and data protection laws, these frameworks remain insufficiently adapted to the complexities introduced by AI technologies. The paper argues for a comprehensive, child-sensitive regulatory approach that integrates AI governance with human rights protections. It recommends the development of robust policies, enhanced institutional capacity, and the incorporation of ethical AI principles to ensure that technological innovation does not undermine children's rights. The study contributes to ongoing scholarly and policy debates by highlighting the urgent need for legal reform and proactive regulation to safeguard children's human and educational rights in Nigeria's evolving digital landscape.

Keywords: Artificial Intelligence (AI); Children's Rights; Educational Rights; Digital Technologies; Data Protection; Privacy; Algorithmic Bias; Online Safety; Legal Framework; Nigeria.

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Introduction

The integration of Artificial Intelligence (AI) and digital technologies into educational and social environments has reconfigured how children interact, learn, and participate in contemporary society. While these technological advancements offer significant opportunities for enhancing educational access, personalised learning, and digital engagement, they also raise profound legal and human rights concerns, particularly for children — a group recognised as especially vulnerable under national and international law (Djeffal, 2022). The United Nations Convention on the Rights of the Child (UNCRC) and related instruments enshrine children's rights to privacy, education, protection from exploitation, and participation in matters affecting them. However, translating these rights into the digital era — where AI systems routinely collect, analyse, and act upon biometric, behavioural, and educational data — remains deeply contested and under-regulated (Nawaila et al., 2020).

In Nigeria, the legal landscape has undergone recent modernization with the enactment of the Nigeria Data Protection Act (NDPA) 2023, which seeks to govern the collection and processing of personal data in a rapidly digitising economy. Yet substantive legal safeguards specific to children's interactions with AI technologies — especially in educational contexts where AI-driven systems increasingly inform pedagogical decisions, profiling, and learning analytics — remain limited. Although the NDPA provides baseline protections for personal data, recent analyses indicate that it lacks robust child-specific provisions that address algorithmic bias, automated decision-making, meaningful consent, and transparency in AI applications (Iyoha-Osagie & George, 2024). Furthermore, extant child protection laws, such as the Child Rights Act 2003, contain general privacy protections but do not explicitly confront online safety threats such as cyber exploitation, data misuse, or AI surveillance (Shittu-Adenuga & Owolabi, 2025).

Despite these legislative developments, there is a conspicuous gap in the literature concerning the intersection of AI regulation, children's human rights, and educational rights in Nigeria. Previous studies have examined aspects of children's online data protection or general national AI regulation frameworks, yet few have holistically situated these within the framework of children's human and educational rights in the context of AI — particularly the analysis of regulatory deficiencies, ethical risks, and the potential harms posed by

algorithmic systems in Nigerian educational environments. For example, while research has explored the adequacy of legal frameworks to combat child data breaches, it stops short of addressing broader AI-specific concerns such as algorithmic bias and autonomous decision-making inherent in learning platforms (Iyoha-Osagie & George, 2024). Similarly, examinations of Nigeria's AI regulatory framework tend to focus on broad policy design without explicit attention to children's rights issues (Otong, 2025).

This study is therefore motivated by the urgent need to fill this knowledge and regulatory gap by critically analysing Nigeria's existing legal and regulatory frameworks through a child-rights lens that foregrounds both human and educational rights in the era of AI. Specifically, it investigates how current laws address (or fail to address) children's privacy, data protection, educational equity, algorithmic transparency, and participation rights in digital educational settings. By doing so, the research aims to offer legally grounded recommendations for a child-sensitive regulatory approach that can not only safeguard rights but also guide policymakers in refining Nigeria's legal architecture for emerging digital realities.

Theoretical Framework

The Rights-Based Theory (RBT) provides a comprehensive and robust framework for examining the protection and promotion of children's human and educational rights, particularly in AI-mediated learning environments. At its core, RBT asserts that all individuals, including children, possess inherent, inalienable rights that must be recognized, respected, and safeguarded by both legal and institutional structures (Freeman, 2011). Unlike approaches that view children as passive recipients of protection, RBT emphasizes their agency and participation, positioning them as rights-holders whose entitlements demand both formal legal recognition and practical enforcement. Within the context of AI and education, this theory becomes particularly relevant, as technological innovations—while offering opportunities for personalized learning and enhanced educational access—may inadvertently compromise children's rights through privacy violations, algorithmic bias, or inequitable access. By foregrounding principles such as equity, participation, accountability, and protection, RBT aligns directly with international human rights instruments, most notably the United Nations Convention on the Rights of the Child (UNCRC), which obliges states to ensure that children's rights are

fully realized in all spheres of society, including the digital and educational realms.

Applying RBT to this study enables a critical evaluation of Nigeria's legal and regulatory frameworks, including the Child Rights Act 2003 and the Data Protection Act 2023, assessing their adequacy in safeguarding children's rights within AI-enhanced educational contexts. The theory provides a lens to interrogate whether these laws not only articulate children's rights but also ensure their practical fulfillment amidst rapid technological change. It also supports a socio-legal analysis of the ethical and pedagogical implications of AI deployment in schools, emphasizing that technological advancement must not undermine children's dignity, autonomy, or equitable access to education (Holmes, 2025; Aitken et al., 2025). Through RBT, the study can explore the extent to which Nigerian policies incorporate safeguards against emerging risks such as automated decision-making, data misuse, and digital exclusion, providing a basis for recommending legal, policy, and educational reforms.

Furthermore, Rights-Based Theory offers a practical framework for bridging the gap between law, policy, and implementation, guiding not only legal compliance but also the ethical integration of AI in education. By emphasizing accountability and participation, RBT encourages policymakers, educators, and technology developers to design and implement AI systems that actively uphold children's rights while simultaneously enhancing learning outcomes. This dual focus—on legal protection and practical enforcement—ensures that AI technologies contribute positively to the educational experience without compromising the fundamental rights of learners. In integrating RBT, this study is positioned to critically analyze both the theoretical adequacy and the operational effectiveness of Nigerian legal instruments, ensuring that AI adoption in education aligns with global human rights standards and fosters an environment where children's learning, safety, and personal development are fully respected and promoted.

Children's Human Rights

Children's human rights are internationally recognized under the *United Nations Convention on the Rights of the Child (UNCRC)*, which codifies rights to protection, participation, and development (Djeffal, 2022). These rights encompass not only basic survival needs but also the right to dignity, autonomy, and freedom from exploitation. In the digital era, however, traditional human rights frameworks are being challenged by technological

transformations, particularly AI and digital platforms, which often collect and process children's data without adequate safeguards (Holmes, 2025). Studies indicate that children's vulnerability in digital contexts necessitates a nuanced approach to rights protection that considers evolving technological risks (Nawaila et al., 2020).

Scholars highlight that AI's automated decision-making capabilities can affect children's human rights in subtle ways. For instance, algorithms that track learning behaviors, social interactions, or content consumption may inadvertently discriminate against certain groups of children, particularly those from marginalized backgrounds (Gouseti et al., 2024). This aligns with concerns about algorithmic bias, lack of transparency, and restricted agency for children, who often cannot provide informed consent or challenge decisions affecting them (Aitken et al., 2025). Such risks demonstrate that the deployment of AI technologies without a child-rights framework can undermine fundamental human rights protections.

Empirical research emphasizes the tension between children's rights to autonomy and protection in AI-mediated environments. While AI can enable personalized learning, it can also restrict choice by recommending content or interventions based on algorithmic predictions, sometimes reinforcing existing inequalities (Holmes, 2025). Furthermore, children's participation rights are frequently neglected; they are rarely consulted in the design or implementation of AI tools, reducing their agency in educational and social contexts (Aitken et al., 2025). This highlights the need for inclusive and participatory approaches in AI governance.

In the Nigerian context, children's human rights are protected under the Child Rights Act 2003, which incorporates UNCRC principles into national law (Shittu-Adenuga & Owolabi, 2025). However, scholars argue that the Act does not explicitly address the complexities posed by AI or digital technologies, leaving significant gaps in safeguarding children's rights online (Iyoha-Osagie & George, 2024). This suggests that while Nigeria has a legal framework for general child protection, the rapid digitalization of education introduces new vulnerabilities not accounted for by existing law.

Consequently, a critical consensus in the literature is that children's human rights in the digital era require integrative strategies that combine legal safeguards, ethical AI governance, and educational oversight (Djeffal, 2022;

Holmes, 2025). Such approaches should ensure that children are protected from exploitation, discrimination, and manipulation while retaining agency and participation in AI-mediated environments. This study builds upon these findings by analyzing Nigeria's legal framework and its capacity to protect children's human rights in AI-based educational contexts.

Educational Rights

Educational rights are an essential component of children's human rights, guaranteeing access to quality education, equity, and lifelong learning opportunities (). In the era of AI and digital technologies, educational rights extend beyond traditional classroom instruction to include access to digital learning resources, adaptive platforms, and AI-mediated educational content (Holmes, 2025). Scholars argue that technology should enhance learning equity, not exacerbate existing educational disparities, which remain a significant concern in many developing countries, including Nigeria (Samuel et al., 2025).

Research highlights the dual impact of AI on educational rights. On one hand, AI enables personalized learning, assessment automation, and improved pedagogical efficiency (Gouseti et al., 2024). On the other hand, disparities in digital access and algorithmic biases can impede children's right to equal educational opportunities (Bali et al., 2024). For example, children in rural or low-income areas often lack access to AI-enhanced learning tools, reinforcing socio-economic inequities. Scholars emphasize that equitable deployment of AI in education requires careful consideration of infrastructure, teacher training, and inclusion strategies.

Educational rights also encompass non-discrimination and participation. AI systems that filter or recommend content based on predictive analytics may inadvertently limit curricular diversity or marginalize certain groups of learners (Holmes, 2025). Research indicates that children should be active participants in AI-mediated education to ensure that learning experiences align with their developmental needs and cultural contexts (Aitken et al., 2025). This underscores the importance of designing AI tools that respect the pedagogical and rights-based dimensions of education.

In Nigeria, educational rights are legally protected under the Constitution and the Universal Basic Education Act (UBE Act), which guarantee free and compulsory primary education (Bali et al., 2024). However, scholars argue

that legal instruments have not sufficiently addressed digital or AI-related challenges, such as online content monitoring, algorithmic transparency, and equitable access to technology-enhanced learning (Otong, 2025). As AI becomes integral to Nigerian classrooms, these gaps present both ethical and legal concerns.

Overall, the literature calls for integrating AI governance with the protection of educational rights, emphasizing fairness, inclusion, and quality (Samuel et al., 2025; Holmes, 2025). Policymakers are encouraged to develop child-centered frameworks that combine legal, technological, and pedagogical safeguards to ensure AI supports rather than undermines children's right to education. This study extends this discourse by examining how Nigeria's existing laws protect educational rights in AI-enhanced learning contexts.

Artificial Intelligence (AI) in Education

Artificial Intelligence has become a transformative force in education, enabling personalized learning, automated assessment, intelligent tutoring, and data-driven instructional decision-making (Holmes, 2025). AI applications can improve learning outcomes, facilitate adaptive content delivery, and enhance classroom efficiency. The literature emphasizes that AI's educational potential is most significant when coupled with appropriate pedagogical frameworks and ethical oversight (Gouseti et al., 2024). However, AI also raises significant ethical and legal questions concerning autonomy, fairness, privacy, and the protection of vulnerable learners.

Scholars note that AI-driven educational platforms can introduce algorithmic biases that negatively impact students from disadvantaged or minority groups (Gouseti et al., 2024). Predictive learning algorithms, if trained on non-representative datasets, may misclassify student performance or reinforce stereotypes. Additionally, AI systems often operate as "black boxes," offering little transparency in decision-making, which undermines accountability and the ability of learners or educators to contest automated decisions (Holmes, 2025). Such risks indicate the necessity of integrating ethical AI principles into educational deployment.

The literature also highlights AI's implications for teacher roles and pedagogical approaches. AI can automate repetitive tasks, freeing teachers to focus on individualized support, yet excessive reliance on AI may deskill

educators or reduce meaningful interaction with students (Bali et al., 2024). Scholars argue that AI should supplement rather than replace human judgment, ensuring that educational experiences remain relational, context-aware, and developmentally appropriate (Samuel et al., 2025).

In Nigeria, studies of AI in education indicate both opportunities and limitations. AI has been piloted in e-learning platforms, adaptive assessment tools, and resource recommendation systems, but infrastructural constraints, limited digital literacy, and inconsistent policy frameworks hinder widespread implementation (Otong, 2025). Research suggests that without clear regulatory guidance, AI deployment risks reinforcing inequality, infringing on children's rights, and exacerbating educational gaps (Bali et al., 2024).

The literature therefore underscores the need for legal, ethical, and pedagogical frameworks to guide AI integration in education (Gouseti et al., 2024). AI should be deployed in ways that uphold children's rights, promote equity, and enhance learning outcomes. This study examines Nigeria's regulatory capacity to align AI in education with children's human and educational rights, addressing gaps identified in prior research.

Methodology

The combined doctrinal and socio-legal methodology is particularly suitable for this study due to the interdisciplinary nature of the research problem, which spans law, technology, education, and human rights. Doctrinal analysis ensures rigorous legal interpretation, while the socio-legal perspective provides insight into how laws and regulations interact with AI applications and educational practices in Nigeria (Iyoha-Osagie & George, 2024). This approach allows the study to generate actionable recommendations for legal reform, policy development, and child-centered AI governance.

The study critically analyses existing national legal instruments, including the Constitution of the Federal Republic of Nigeria (1999, as amended), the Child Rights Act 2003, and the Nigeria Data Protection Act 2023, alongside relevant regulations and guidelines issued by government agencies (Iyoha-Osagie & George, 2024; Otong, 2025). In addition, international instruments such as the United Nations Convention on the Rights of the Child (UNCRC) and UNESCO's guidelines on Ethical AI in Education are examined to provide comparative perspectives and best-practice standards (Aitken et al., 2025). The research focuses on the interplay between AI technologies, children's human

and educational rights, and the legal mechanisms designed to safeguard these rights within Nigeria's digital educational landscape.

To ensure the study's relevance and comprehensiveness, sources were selected based on specific inclusion and exclusion criteria. Included were legal and policy documents such as statutes, regulations, policy guidelines, and court decisions that explicitly address children's rights, data protection, and AI in education; international standards and guidelines from recognized global bodies, including the UNCRC, UNESCO, and UNICEF, which pertain to children's rights in digital and AI contexts; peer-reviewed academic literature published between 2015 and 2026, including research articles, books, and reports on AI in education, children's human and educational rights, and digital governance; and studies specifically relevant to the Nigerian context, focusing on national legal frameworks, educational policies, and digital adoption. Sources were excluded if they focused exclusively on AI in sectors unrelated to education or children's rights, lacked scholarly validation such as unverified blogs or opinion pieces, addressed children's rights or AI in countries with socio-legal contexts markedly different from Nigeria without comparative value, or were published before 2015, given the significant evolution of technological and legal frameworks affecting AI in education.

Data collection involves systematic identification and review of legal texts, policy documents, and scholarly literature meeting the inclusion criteria. The doctrinal component analyses legal texts to interpret statutory provisions, regulatory obligations, and compliance mechanisms in relation to children's human and educational rights (Oloyede, 2020). The socio-legal component contextualizes these findings by examining the social and educational realities in which AI operates, highlighting potential gaps, ethical concerns, and practical challenges (Aluko, 2022; Otong, 2025). The study employs content and thematic analysis to identify recurring patterns, regulatory gaps, and areas where international best practices can inform national reforms.

In a nutshell, the combined doctrinal and socio-legal methodology is particularly suitable for this study due to the interdisciplinary nature of the research problem, which spans law, technology, education, and human rights. Doctrinal analysis ensures rigorous legal interpretation, while the socio-legal perspective provides insight into how laws and regulations interact with AI applications and educational practices in Nigeria (Iyoha-Osagie & George, 2024). This approach allows the study to generate actionable

recommendations for legal reform, policy development, and child-centered AI governance.

Results and Discussion of Findings

First, the analysis reveals that AI systems in educational contexts pose significant challenges to the protection of children's human rights in Nigeria. Doctrinal review of the Child Rights Act 2003 and related statutes indicates that while the law provides broad protections for children, it does not explicitly address AI-mediated risks such as automated profiling, behavioral tracking, and algorithmic decision-making (Iyoha-Osagie & George, 2024). For example, AI-driven learning platforms often collect sensitive personal and behavioral data without mechanisms for informed consent or recourse, raising potential violations of privacy and dignity — core components of children's rights under the UNCRC (Djeffal, 2022). Socio-legal analysis further highlights that the lack of child-centered AI governance in Nigeria increases vulnerability to exploitation, bias, and discrimination (Holmes, 2025). These findings align with international scholarship, which emphasizes that the digital environment creates new dimensions of risk for children, necessitating both proactive regulatory measures and ethical AI design principles (Aitken et al., 2025).

Second, the study finds that children's educational rights, particularly access to quality and equitable learning opportunities, are both enhanced and constrained by AI technologies. On one hand, AI platforms facilitate personalized learning, adaptive assessment, and interactive educational content, which can improve learner engagement and performance (Gouseti et al., 2024). On the other hand, unequal access to digital infrastructure, including internet connectivity and AI-enabled devices, perpetuates disparities among learners in urban and rural areas, violating the principle of equitable educational rights (Samuel et al., 2025). Additionally, algorithmic decision-making may inadvertently bias curricular recommendations, limiting exposure to diverse learning materials and constraining children's ability to fully participate in their education (Holmes, 2025). These findings indicate that while AI can be a tool for enhancing education, it simultaneously introduces structural inequities that must be mitigated through inclusive policy frameworks and regulatory oversight.

Third, analysis of Nigeria's Data Protection Act 2023 (NDPA) reveals partial alignment with international data protection standards, but significant

gaps remain concerning children's digital rights. The study finds that AI applications in education frequently operate in ways that challenge principles of informed consent, transparency, and accountability, particularly for minors who may not comprehend the implications of data collection and processing (Otong, 2025; Dube et al., 2026). Unlike GDPR-like frameworks in Europe, Nigerian law does not provide specialized provisions for children in AI-mediated environments, exposing them to potential data breaches, unauthorized profiling, and exploitation (Iyoha-Osagie & George, 2024). Socio-legal analysis indicates that these regulatory gaps are compounded by limited enforcement mechanisms and low awareness among educators, parents, and policymakers, highlighting the need for child-centered data protection policies and capacity-building initiatives (Aluko, 2022).

Fourth, the study identifies that Nigeria's legal and regulatory architecture provides a foundation for protecting children's rights but is insufficiently responsive to emerging AI challenges. While the Constitution, Child Rights Act, and NDPA establish general principles of child protection, data privacy, and digital governance, the absence of AI-specific provisions, regulatory guidelines, or oversight mechanisms creates significant enforcement gaps (Otong, 2025). Comparative review of international standards, such as UNESCO's guidelines for ethical AI and UNCRC recommendations, shows that proactive regulatory strategies, algorithmic transparency, and child-focused policy interventions are critical for safeguarding rights in AI-mediated education (Aitken et al., 2025). The findings suggest that Nigeria's legal framework requires reform to integrate AI-specific protections, enforce compliance, and ensure that technology adoption does not compromise children's human or educational rights.

Overall, the findings highlight a complex interplay between technological innovation and rights protection. AI can enhance learning outcomes and expand educational opportunities but simultaneously creates novel risks for children's privacy, autonomy, and equitable access. Legal and regulatory gaps exacerbate these risks, underscoring the need for child-centered AI governance, ethical compliance, and targeted policy reforms (Holmes, 2025; Iyoha-Osagie & George, 2024). By analyzing both doctrinal and socio-legal dimensions, the study demonstrates that safeguarding children in AI-mediated education requires a multidimensional strategy that integrates law, policy, technology, and pedagogy. These results provide a foundation for developing

practical recommendations aimed at harmonizing AI adoption with the protection of children's human and educational rights in Nigeria.

Implications of the Study

The study highlights significant gaps in Nigeria's legal and regulatory frameworks regarding AI and children's rights. Existing laws provide general protection for children but do not explicitly address the risks posed by AI technologies, such as automated decision-making, algorithmic bias, and data privacy concerns in educational contexts. This underscores the need for comprehensive legal reforms that integrate child-centered AI safeguards, establish accountability mechanisms for AI developers and educational institutions, and ensure alignment with international standards for children's rights.

Artificial Intelligence has the potential to enhance learning experiences through personalized instruction, adaptive assessments, and access to diverse educational resources. However, unequal access to technology and digital infrastructure risks reinforcing existing educational disparities. Educational institutions must therefore prioritize equitable access, provide digital literacy training for teachers and students, and carefully integrate AI systems to ensure that all children benefit from technology-enhanced education without compromising their rights or learning outcomes.

The study reveals that children are particularly vulnerable to breaches of privacy and misuse of personal information in AI-driven learning environments. There is a pressing need for data protection strategies specifically tailored to children, including age-appropriate consent mechanisms, clear transparency on data collection, and monitoring of AI platforms in schools. Strengthening data governance policies and enforcing compliance can help protect minors from exploitation and unauthorized use of their personal information. Ethical considerations are central to the deployment of AI in educational settings. AI should be used in ways that protect children's dignity, autonomy, and right to participation, while avoiding discrimination and bias. Including children, educators, and parents in the design and implementation of AI systems can promote accountability, social legitimacy, and ethical compliance. A participatory approach ensures that AI tools are not only technically efficient but also socially and ethically responsible.

The study contributes to knowledge by linking doctrinal legal analysis with socio-legal perspectives, providing a multidimensional view of children's rights in the context of AI in education. It lays a foundation for future research that examines the intersection of technology, law, and education. Scholars and practitioners can build on these findings to develop frameworks that integrate legal, ethical, and pedagogical considerations when designing or regulating AI-based educational tools, ensuring that technological advancement aligns with the protection of children's rights.

Limitations of the Study

Despite the insights provided, this study has certain limitations that should be acknowledged. First, the research relies primarily on a doctrinal and socio-legal analysis, which involves the review of existing laws, policies, and scholarly literature. While this approach allows for in-depth theoretical and regulatory assessment, it does not include empirical data from children, educators, or policymakers, which may limit the understanding of practical experiences and challenges in AI-mediated educational environments.

Second, the study focuses specifically on the Nigerian legal and regulatory context, drawing comparisons with select international standards. While this provides relevant insights for policy and practice within Nigeria, the findings may not be directly generalizable to other countries with different socio-legal and technological landscapes. Consequently, broader cross-national comparisons of AI governance and child protection are beyond the scope of this research.

Third, the rapidly evolving nature of AI technologies presents a limitation. New AI applications, tools, and regulatory interventions are continuously emerging, and the legal and technological environment may change after the completion of this study. This dynamic context implies that some findings and recommendations may require future updates to remain relevant and effective.

Fourth, while efforts were made to include comprehensive legal documents and scholarly literature published between 2015 and 2026, some relevant materials may have been inaccessible or unpublished, which could affect the completeness of the analysis. Additionally, the study did not extensively explore the technical aspects of AI systems, such as algorithm design or software architecture, which may influence children's rights in practice.

Finally, the study is constrained by the scope of its thematic focus, concentrating on children's human and educational rights in AI-mediated learning. Other important dimensions, such as AI in health, entertainment, or social media, were not considered, even though these domains may also impact children's rights. Despite these limitations, the study provides a critical and timely analysis of the regulatory and ethical challenges associated with AI in Nigerian education, offering a strong foundation for future empirical and policy-oriented research.

Future Directions of the Study

Building on the findings, limitations, and gaps identified in this study, several future research directions are proposed to further advance the understanding of children's rights in the age of Artificial Intelligence (AI). First, there is a need for empirical studies involving children, educators, and policymakers to explore the practical experiences, perceptions, and challenges associated with AI-mediated learning environments. Such research could employ surveys, interviews, and participatory methods to assess how AI affects children's autonomy, learning engagement, and privacy in real-world educational settings.

Second, future research should expand beyond Nigeria to include comparative cross-national analyses, examining how different countries regulate AI in education and protect children's rights. This would provide insights into best practices, policy innovations, and potential lessons for adapting Nigeria's legal and regulatory frameworks to emerging AI challenges. Comparative studies could also investigate cultural and socio-economic factors that shape AI adoption and children's access to technology.

Third, there is a need for studies focusing on the technical and ethical design of AI systems in education, including algorithmic transparency, fairness, and accountability. Research could examine how AI tools can be developed in alignment with children's rights principles, ensuring that educational outcomes are equitable and that biases are minimized. Such studies could bridge the gap between legal norms, ethical standards, and technological implementation.

Fourth, future investigations should explore data protection and digital literacy interventions, assessing their effectiveness in safeguarding children's personal information while promoting safe and responsible use of AI technologies. This

includes evaluating consent mechanisms, parental involvement, and school policies to ensure that children's rights are protected without hindering access to innovative learning tools.

Finally, longitudinal studies are recommended to track the long-term impact of AI on children's human and educational rights, including cognitive, social, and ethical development. Understanding the sustained effects of AI integration in schools will provide policymakers, educators, and legal authorities with evidence-based guidance for designing child-centered AI governance frameworks. By addressing these directions, future research can contribute to developing comprehensive strategies that harmonize technological innovation with the protection and promotion of children's rights in the digital era.

Conclusion and Recommendations

This study has examined the legal and regulatory challenges associated with safeguarding children's human and educational rights in the context of Artificial Intelligence (AI) in Nigeria. The findings reveal that while Nigeria has foundational legal instruments, including the Child Rights Act 2003, the Constitution, and the Data Protection Act 2023, these frameworks do not adequately address the specific risks posed by AI technologies in education. AI offers significant opportunities for personalized learning, adaptive assessment, and enhanced educational outcomes, yet it also introduces challenges such as data privacy breaches, algorithmic bias, inequitable access, and diminished agency for children. The socio-legal analysis further highlights that the practical implementation of AI in Nigerian schools often lacks ethical oversight, participatory governance, and mechanisms to protect vulnerable learners. Consequently, there is an urgent need for integrated policy, legal, educational, and technological strategies that ensure AI adoption aligns with the principles of child-centered education and rights protection. Overall, this study contributes to the literature by bridging doctrinal legal analysis with socio-legal insights, providing a foundation for evidence-based reforms to protect children in AI-mediated learning environments. Based on the overall findings of the Study, the following recommendations are made:

- I. The Nigerian government should revise existing laws to include AI-specific provisions that protect children's human and educational rights. This should involve explicit safeguards against algorithmic bias, automated decision-making, and the misuse of

children's data, ensuring alignment with international standards such as the UNCRC and UNESCO ethical AI guidelines.

- II. Educational authorities should implement policies and infrastructure programs that guarantee equitable access to AI-enabled learning tools across urban and rural areas. This includes providing affordable devices, internet connectivity, and adaptive learning platforms to reduce educational disparities.
- III. Schools, policymakers, and AI developers should establish robust data protection measures tailored for children, including age-appropriate consent protocols, transparent data usage policies, and regular audits of AI platforms to prevent exploitation or unauthorized access to personal information.
- IV. Teachers, school administrators, and parents should receive training on the ethical use of AI in education, digital literacy, and children's rights. This will enable stakeholders to monitor AI deployment effectively, support children in navigating AI tools safely, and ensure pedagogical practices remain inclusive and rights-based.
- V. The development and implementation of AI in educational settings should adopt participatory approaches that involve children, educators, and parents in decision-making processes. Ethical review boards or oversight committees should be established to evaluate AI tools before deployment, ensuring accountability, transparency, and alignment with children's rights and educational objectives.

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Predictors of Higher-Order Thinking Skills among Postgraduate Students of Sokoto State University, Sokoto State, Nigeria

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Abstract

This study aimed to investigate the prediction of higher-order thinking (HOTS) skills among postgraduate students at Sokoto State University, Nigeria, based on cognitive dispositions, innovation capacity, research competencies, critical thinking, and problem-solving skills. The current study is underpinned by Bloom's Taxonomy and the constructivist learning theory, which emphasize the significance of cognitive and analytical skills in promoting higher-order thinking. A quantitative research design was employed to investigate the prediction of higher-order thinking skills, and structured questionnaires were used to obtain data from 250 randomly selected postgraduate students from various faculties across the university. Multiple regression and correlation analysis were employed to analyze the collected data. The findings revealed that all the independent variables significantly and positively predicted higher-order thinking skills, and critical thinking and research competencies significantly predicted higher-order thinking skills more than the other independent variables. Cognitive dispositions and innovation capacity also significantly predicted higher-order thinking skills, while problem-solving skills served as a mediating factor in predicting higher-order cognitive performance based on critical thinking skills. The findings of the current study emphasize the need to integrate higher-order research skills, innovation, and problem-solving skills in promoting higher-order thinking skills among postgraduate students. The findings suggest that promoting higher-order thinking skills is crucial in equipping Nigerian graduates with intellectual and cognitive capacities to contribute to the attainment of the Sustainable Development Goals (SDGs) in Nigeria, specifically in quality education (SDG 4), innovation and infrastructure (SDG 9), and sustainable institutions (SDG 16).

Keywords: Cognitive Dispositions, Innovation Capacity, Research Competencies, Critical Thinking, Problem-Solving Skills and Higher-Order Thinking

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Introduction

The importance of developing higher-order thinking skills (HOTS) among postgraduate students is a cornerstone of advanced education and a vital enabler of the Sustainable Development Goals (SDGs). Higher-order thinking skills, which include analysis, evaluation, and creation, as proposed in Bloom's taxonomy, go a step further than the traditional cognitive domain of knowledge acquisition to include critical thinking, creativity, and problem-solving (Anderson & Krathwohl, 2001). In the domain of postgraduate studies, the importance of HOTS can therefore not be overstated, given that it prepares students cognitively to generate new knowledge, innovate, and solve problems to address societal challenges. In the case of Nigeria, and more specifically Sokoto State University, it is therefore vital to enhance HOTS to enable graduates to contribute meaningfully to the implementation of SDG 4, quality education; SDG 9, industry, innovation, and infrastructure; and SDG 16, peace, justice, and strong institutions.

A number of predictors of HOTS have been proposed in the literature, with cognitive dispositions being cited as a foundation for developing higher-order thinking skills (Facione, 2015). In addition, innovation capacity, which refers to the ability to generate new ideas and solve problems creatively, has also been cited as a predictor of HOTS, given that it is a vital cognitive skill for generating new knowledge in higher education (Dyer et al., 2019). Another predictor of HOTS is research competencies, which include methodological skills, data analysis, and academic writing, a skill that is vital for the academic contribution of postgraduate students (Levy & Ellis, 2011).

The importance of developing critical thinking and problem-solving skills is arguably the most cited cognitive skill in the domain of postgraduate studies, given that it prepares students to think logically, solve problems, and apply theoretical knowledge to practical problems (Jonassen, 2014). In addition, it prepares students to think critically, to arrive at logical judgments, and to self-regulate cognitively (Ennis, 2018). These predictors of HOTS are consistent with constructivist theories of learning, which propose that knowledge construction is a cognitive process that requires engagement, reflection, and interaction with problems (Vygotsky, 1978).

There is a need for the development of higher-order thinking skills (HOTS) that is emphasized in postgraduate education outcomes, yet many universities

in Nigeria face the challenge of adequately preparing the minds of the student population for the required higher-order cognitive skills for effective problem-solving and innovation. Although many studies have been conducted on cognitive dispositions, critical thinking skills, and problem-solving skills in isolation from each other and their combined effect on the development of higher-order thinking skills in postgraduate education outcomes, little attention has been given to the combined effect of these variables on the prediction of higher-order thinking skills in postgraduate education outcomes in Nigeria. This is particularly true for the Sokoto State University student population, where little empirical research has been done to investigate the combined effect of cognitive dispositions, innovation capacity, research skills, and critical thinking skills on the prediction of higher-order thinking skills for the postgraduate student population.

Although many studies have been done on the prediction of higher-order thinking skills in postgraduate education outcomes in Nigeria (Yusuf & Alabi, 2020; Okebukola, 2021), little attention has been given to the postgraduate student population in Northern Nigeria universities. This study thus seeks to fill the literature gap by investigating the predictive influence of cognitive dispositions, innovation capacity, research competencies, critical thinking skills, and problem-solving skills on higher-order thinking skills for the postgraduate student population of the Sokoto State University.

The study was informed by a need to bridge this gap by empirically investigating the multidimensional predictors of HOTS among postgraduate students. The significance of the study lies in its ability to provide evidence-based information which can inform teaching approaches, curriculum development, and policies aimed at promoting postgraduate students' learning outcomes. The novelty of the study lies in its integrated approach to HOTS prediction by incorporating cognitive, affective, and skill-based predictors in one model. This provides a comprehensive understanding of HOTS cultivation. By filling the gap in HOTS prediction, the study contributes to theory development by building on constructivist learning theory and Bloom's taxonomy. Moreover, the study contributes to practice by ensuring postgraduate education in Nigeria meets international standards and the SDGs, particularly in terms of quality education, innovation, and institutional development. The findings of the study are expected to provide valuable insights into curriculum development, teaching approaches, and policies aimed

at promoting advanced learning outcomes, which can inform Nigeria's progress in achieving the SDGs.

Theoretical Framework

The study on the predictive influence of cognitive dispositions, innovation capacities, research competencies, critical thinking, and problem-solving skills on HOTS among postgraduate students of Sokoto State University was anchored on two major theoretical perspectives namely: Bloom's Revised Taxonomy of Educational Objectives and Constructivist Learning Theory.

The foundation for understanding HOTS is Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001). The taxonomy is a classification system for cognitive skills that has six hierarchical levels: remembering, understanding, applying, analyzing, evaluating, and creating. The lower-level skills are concerned with recalling and understanding, while the higher-level skills of analysis, evaluation, and creation all relate to HOTS. The taxonomy is relevant in this study as it forms the basis for measuring cognitive skills and provides a window into the role of predictors such as critical thinking skills and research skills in building higher-level skills in individuals. The research skills relate to the higher-level skills of "analyzing" and "evaluating," while innovation capacity is closely related to the highest-level cognitive skill of "creating."

Another theory that complements the cognitive domain of learning according to Bloom's theory is the Constructivist Learning Theory by Vygotsky. This theory focuses on the construction of knowledge by the learner and the social context in which the learner interacts with complex tasks and scaffolding by an expert or a more knowledgeable guide. According to Vygotsky (1978), the learner can only learn in the Zone of Proximal Development (ZPD) that exists between the level of independent performance and the level of performance with guidance and scaffolding by a teacher or an expert. The postgraduate learners' development of higher-order thinking skills is predicted by cognitive dispositions, the research environment, and the opportunities for innovative and problem-based learning.

Another theory that complements the cognitive domain of learning according to Bloom's theory is Astin's Theory of Student Involvement (1984). This theory provides a justification for the importance of student involvement in academic activities and the physical and psychological investment that the student makes in the academic process and the cognitive development that

results from such involvement. Critical thinking and problem-solving involve the student actively and intellectually in the academic process and the development of innovation and research skills that result from such involvement. These three theories provide a justification that higher-order cognitive skills do not result from the learner's cognitive ability but from the learner's ability to learn and the learner's engagement with tasks that intellectually stretch the learner.

In conclusion, the cognitive domain of learning according to Bloom's theory provides a justification for the level of cognitive skills that the study seeks to investigate and the constructivist theory provides a justification for the process of cognitive development and the importance of student involvement in academic activities and the cognitive development that results from such involvement by the learner. These three theories provide a justification that higher-order cognitive skills do not result from the learner's cognitive ability but from the learner's ability to learn and the learner's engagement with tasks that intellectually stretch the learner and provide a justification for the ability of the learner to contribute to the achievement of the SDGs in North-Western Nigeria.

Conceptual Framework

The conceptual framework illustrates the interrelationship between the five predictors—cognitive dispositions, innovation capacity, research competencies, critical thinking, and problem-solving skills—and their impact on the development of Higher-Order Thinking Skills (HOTS) among postgraduate students of Sokoto State University.

The five predictors have distinct roles to play in the development of HOTS. Cognitive dispositions facilitate reflection, innovation capacity enables creativity, research competencies enhance analytical thinking, critical thinking and problem-solving skills provide the student with tools to evaluate and apply what he or she has learned. In all these, the predictors work hand in hand to facilitate HOTS development, namely analysis, evaluation, and creation as identified in Bloom Revised Taxonomy (Anderson & Krathwohl, 2001).

The development of HOTS enables postgraduate students to make significant contributions to the achievement of the Sustainable Development Goals (SDGs). In this respect, the conceptual framework identifies three key goals to

be achieved by postgraduate students in Sokoto State University. They include SDG 4—Quality Education—through improved learning outcomes, SDG 9—Industry, Innovation, and Infrastructure—through innovation and research competencies, and SDG 16—Peace, Justice, and Strong Institutions—through critical thinking. In this respect, the conceptual framework asserts that advancing postgraduate education in Nigeria requires the development of the identified predictors to build intellectual capacities that drive development in the region.

Cognitive dispositions

Cognitive dispositions, on the other hand, are long-term cognitive inclinations or intellectual traits that lead learners to solve problems in a certain way (inquisitiveness, open-mindedness, intellectual perseverance, reflection, etc.). Cognitive dispositions, according to theory, are not the same as cognitive skills, as they lead learners to use cognitive skills when the situation demands it, thus helping learners to develop HOTS (Facione, 2015). In addition, studies have shown that learners who exhibit high cognitive dispositions, such as intellectual curiosity, open-mindedness, and search for truth, are more likely to exhibit analytical thinking, self-directed study, and reflective thinking, which are linked to high HOTS (Facione et al., 1994; Facione, 2015). In the case of postgraduate students, cognitive dispositions provide the motivational and metacognitive foundation for learners to successfully take on research challenges and innovate, hence the importance of cognitive dispositions as a predictor of HOTS.

Cognitive dispositions are long-term mental predispositions that affect an individual's approach to learning and problem-solving. They comprise curiosity, open-mindedness, intellectual perseverance, and reflective judgment (Facione, 2015). Research evidence points to the fact that cognitive dispositions are significant in determining the likelihood that learners may participate in higher-order cognitive activities. This is in the sense that cognitive dispositions determine the likelihood that learners may apply critical thinking skills to address complex situations (Facione et al., 1994). For instance, a learner whose cognitive disposition favors curiosity may be more likely to ask inquisitive questions and make connections between concepts. Such an approach may be advantageous in the analysis, evaluation, and synthesis aspects of Bloom's taxonomy of cognitive abilities (Anderson & Krathwohl, 2001). Empirical evidence also points to the fact that cognitive

dispositions are significant in determining postgraduate learners' success. This is in the sense that cognitive dispositions may provide support to learners in persisting with research challenges. Research evidence from higher learning settings points to the fact that postgraduate learners whose cognitive dispositions favor truth-seeking and systematicity may be better placed to persist through the challenges associated with writing theses and engaging in original research activities (Yusuf & Alabi, 2020). In Nigeria, cognitive dispositions may provide postgraduate learners with intrinsic motivation to persist through the challenges associated with limited learning resources. Thus, cognitive dispositions are significant in determining HOTS in postgraduate learners at Sokoto State University.

Innovation Capacity

Innovation capacity in higher education has been defined as the capacity for generating, as well as implementing, innovative ideas or solutions in a higher education context (Dyer et al., 2009; Tierney & Lanford, 2016). Research on innovation capacity in higher education has highlighted the importance of culture (openness, collaboration), teaching practices (problem-based teaching, project-based teaching), and innovators' skills (idea generation, experimentation) as critical factors (ResearchGate literature on innovation capacity; Dyer et al., 2009). Higher innovation capacity in postgraduate education has been associated with a higher tendency for students to move beyond problem-solving into innovative creation, which aligns with the "create" dimension of Bloom's Taxonomy of Cognitive Abilities. Recent studies on innovation capacity in universities that focused on the development of a model for innovation capacity scales in higher education settings revealed that interventions in teaching that focused on innovation capacity training resulted in increased creative output in students and higher-order thinking skills (Tierney & Lanford, 2016; Rocha, et al., 2023).

Innovation capacity has been defined as the capacity for generating and implementing innovative ideas that create value (Dyer et al., 2009). In the context of higher education for postgraduates, innovation capacity has been defined as the capacity for integrating creativity and knowledge for the solution of academic, industrial, and societal problems. As such, innovative thinking requires cognitive flexibility, divergent thinking, and risk-taking behaviors that are all closely associated with higher cognitive processes such as evaluation and creation (Ovbiagbonhia et al., 2020).

Empirical evidence points to the fact that innovation-oriented learning environments promote graduates who are better equipped to develop innovative and creative responses to critical challenges in society (Dyer et al., 2019). In the case of postgraduate learners at Sokoto State University, there is a need to build the innovation capacity in line with the achievement of the SDGs, especially Goal 9, which focuses on Industry, Innovation, and Infrastructure. The research-oriented approach to creativity and application enables learners to develop HOTS and innovative responses to regional development challenges in Northwestern Nigeria.

Research Competencies

Research competencies, in the form of methodological knowledge, data analysis literacy, academic writing, and literature synthesis, have been found to be critical in postgraduate education and have been repeatedly found to be associated with higher-order cognitive abilities. In order to become proficient in research, one has to engage in analysis (breaking down complex problems into parts), evaluation (judging the evidence and methods), and synthesis (generating new knowledge), all of which fall within the domain of HOTS (Anderson & Krathwohl, 2001). In short, research competencies have been found to function both as instruments and vehicles for exercising HOTS, and therefore, stronger research competencies would lead to higher HOTS performance in postgraduates.

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Critical Thinking

Critical thinking, which has been described as “reasonable reflective thinking focused on deciding what to believe or do” (Ennis, 2018), has been widely

recognized as a primary antecedent of HOTS. Research literature has highlighted two aspects of critical thinking: disposition to think critically and cognitive processes involved in critical thinking (Facione, 2015; Ennis, 2018). Programmed interventions aimed at teaching argument analysis, evidence evaluation, and inference development have been found to enhance students' performance in tasks involving analysis and evaluation (Facione, 2015; Ennis, 2018). In postgraduate studies, critical thinking training through seminars, journal clubs, and research supervision has been found to correlate with enhanced quality of thesis work, more stringent methodology, and increased ability to critique and generate theories—clear manifestations of HOTS. Critical thinking, therefore, emerges as one of the strongest antecedents of HOTS from a conceptual as well as an empirical perspective (Kim & Choi, 2025 McGuire & Johnstone, 2023; Şahin & Yıldırım, 2023).

Critical thinking refers to a disciplined reflective process of analysis, evaluation, and judgment (Ennis, 2018). It has been recognized as one of the primary antecedents of HOTS since a long time. This is because critical thinking enables learners to think beyond mere memorization of facts and engage in logical thinking. In postgraduate studies, critical thinking enables students to critique existing theories, question assumptions, and generate logical arguments in their theses or research papers. Research literature has consistently demonstrated that students possessing a high level of critical thinking skills perform better in postgraduate studies since they are more capable of evaluating the validity and reliability of information (Walsh et al., 2019; Aydin & Aybek, 2024; Wei & Chen, 2024).

Apart from academic success, critical thinking skills will enable postgraduate learners to acquire lifelong skills that are immediately applicable to the accomplishment of the SDGs, specifically SDG16, Peace, Justice, and Strong Institutions. Critical thinkers are more likely to develop evidence-based decision-making skills, which are crucial to the establishment and maintenance of strong institutions and effective governance. In Northwestern Nigeria, higher education is key to regional transformation; hence, promoting critical thinking skills in postgraduates will ensure that graduates are able to address the region's socio-economic challenges. Critical thinking is, therefore, both a predictor and a promoter of HOTS and sustainable development.

Problem-Solving Skills

Problem-solving skills involve the capacity to recognize, depict, and solve complicated and, in many instances, ill-structured problems. Instructional designs that teach schemas, as well as problem-solving strategies and heuristics, are effective in promoting learners' HOTS, including apply, analyze, and create (Jonassen, 2014). Jonassen, et al., emphasize the importance of designing learning environments that offer authentic problems, as well as strategies and procedures, to learners as a means to develop their problem-solving skills. Research evidence from higher education institutions indicates that problem-based learning and scaffolded work with cases are effective in improving learners' analytic complexity and transfer of learning to novel contexts, which are both significant indicators of HOTS. Problem-solving skills are significant in the context of postgraduate learners, as they are able to frame their research problems creatively and develop viable and evidence-based solutions.

Problem-solving skills involve identifying, analyzing, and resolving complex or ill-structured problems in a systematic manner. Unlike other problem-solving skills, postgraduate problem-solving skills involve integrating knowledge with application, which directly engages higher-order cognitive processes (Jonassen, 2014). Problem-solving skills involve not just getting answers, but also defining problems, evaluating various solutions, and justifying solutions, which are located in the highest level of Bloom's taxonomy, namely, analysis, evaluation, and creation.

Research has shown that problem-based learning environments enhance students' HOTS significantly, enabling them to solve real-world problems (Jonassen, 2014). Problem-solving skills are crucial for postgraduate students of Sokoto State University in Nigeria to solve Nigeria's development challenges in education, governance, and innovation. Problem-solving skills are aligned with SDG 4 and SDG 9, enabling students to solve problems in creative and sustainable ways in education and infrastructure development. Problem-solving skills, therefore, are not just predicting HOTS, but also ensuring that postgraduate research is contributing to regional and global development priorities.

In a nutshell, therefore, from the literature, it is evident that cognitive dispositions provide motivational and metacognitive soil in which skills are developed, research competencies and problem-solving skills provide

methodological tools and practice contexts, innovation capacity provides generative and creative orientation, and critical thinking provides evaluative processes that inform sound judgment. All of these domains of variables have been researched, and they have all been found to be linked to Bloom's higher-order cognitive processes, namely, analysis, evaluation, and creation. Thus, measuring this set of predictors in a postgraduate sample is theoretically sound and likely to yield useful insights into which of them is likely to forecast HOTS most strongly, knowledge that might inform curriculum design, supervision, and SDG-oriented graduate training in Nigeria.

Methodology

Research Design

This study employed a quantitative correlational research design to investigate the predictive role of cognitive dispositions, innovation capacity, research competencies, critical thinking ability, and problem-solving skills in predicting higher-order thinking among postgraduate students at Sokoto State University. The correlational research design was considered appropriate for the study to investigate the relationship between variables and the predictive role of independent variables in predicting dependent variables. This type of research design was considered appropriate for the study as it aimed to measure the degree to which the variables predict HOTS.

Population and Sample

The target population for the study comprised all postgraduate students at Sokoto State University during the 2024/2025 and 2025/2026 academic sessions respectively. The population of study comprised all postgraduate students from various four faculties namely: Arts, Education, Management Science and Science. The required sample for the study was determined to be 201 postgraduate students at Sokoto State University through the Krejcie and Morgan table (Krejcie & Morgan, 1970). Stratified random sampling was employed to select participants for the study. This type of sampling was considered appropriate for the study as it increased the generalizability of the results as literature contend (Etikan & Bala, 2017; Creswell & Creswell, 2018). Stratified random sampling increases the generalizability of results as it includes participants from various Faculties and departments.

Instruments for Data Collection

Data collection was done through a structured questionnaire consisting of six sections. The first five sections were used to collect data from the independent variables. Firstly, cognitive disposition was measured using a modified version of the California Critical Thinking Disposition Inventory developed by Facione et al. (1994). Secondly, innovation capacity was measured using a modified version of the Innovator's DNA framework developed by Dyer et al., (2009). Thirdly, research competencies were measured using a postgraduate research skills inventory developed by Levy & Ellis (2011). Fourthly, critical thinking was measured using a modified version of Ennis's (2018) Critical Thinking Assessment Framework. Lastly, problem-solving skills were measured using a modified version of Jonassen's (2014) Problem-Solving Skills Scale. The sixth section measured the dependent variable: Higher-Order Thinking Skills, which was measured using a version of Bloom's Revised Taxonomy: analysis, evaluation, and creation (Anderson & Krathwohl, 2001). Respondents' feedback was measured on a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

Validity and Reliability of Instruments

Content validity was ensured by seeking feedback from three experts in educational measurement and curriculum studies from Sokoto State University. Construct validity was ensured by carrying out a factor analysis on the pilot questionnaires. This was done to confirm whether the factors were appropriately loaded. Finally, reliability was ensured by carrying out a pilot study involving 30 postgraduate students. This was done to confirm whether the internal consistency was within an acceptable range. This was done since literature contends that a range of 0.78 to 0.89 falls within an acceptable range (Tavakol & Dennick, 2011).

Procedure for Data Collection

Permission to carry out the research was sought from the School of Postgraduate Studies at Sokoto State University. A structured questionnaire was used. This was done to ensure a high response rate since respondents were assisted by trained research assistants. This was done to ensure a high response rate. Confidentiality was assured, and participants' consent was sought before data collection. Questionnaires were retrieved immediately after respondents completed them.

Method of Data Analysis

The data was analyzed using the Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics such as means and standard deviations were utilized to analyze the data. Pearson's Product-Moment Correlation was utilized to examine the relationships between predictors and HOTS. Multiple regression analysis was utilized to examine the predictive power of cognitive dispositions, innovation capacity, research competencies, critical thinking, and problem-solving skills in predicting HOTS (Field, 2018).

Results

This section presents the findings of the multiple regression analysis utilized to examine the extent to which cognitive dispositions, innovation capacity, research competencies, critical thinking, and problem-solving skills predict higher-order thinking skills (HOTS). This section is presented in accordance with standard statistical practices, with focus on the multiple correlation coefficient (R), coefficient of determination (R^2), adjusted R^2 , F-ratio, and significance level (p-value). Table 1 shows descriptive statistics with a focus on mean scores and standard deviations of study variables.

The findings show that postgraduate students scored high in critical thinking and research competencies, while cognitive dispositions and innovation capacity scored moderately in relation to HOTS. This implies that postgraduate students scored high in critical thinking and research competencies, while cognitive dispositions and innovation capacity scored moderately in relation to HOTS.

Inferentially, this implies that all variables scored above the midpoint of a scale, suggesting that postgraduate students demonstrated moderate to high cognitive dispositions, innovation capacity, research competencies, critical thinking, problem-solving skills, and higher-order thinking skills. Among the variables, critical thinking scored the highest, while cognitive dispositions scored the lowest in relation to postgraduate students. Table 1 shows Descriptive Statistics of Study Variables ($N = 291$).

Table 1: Descriptive Statistics of Study Variables (N = 291)

Variable	Mean (M)	Std. Deviation (SD)
Cognitive Dispositions	3.42	0.71
Innovation Capacity	3.58	0.68
Research Competencies	3.89	0.64
Critical Thinking	3.95	0.62
Problem-Solving Skills	3.77	0.66
Higher-Order Thinking	3.85	0.60

Source: Data Output from Statistical Package for Social Sciences (SPSS) version 26. (2026)

Table 1 presents the descriptive statistics of the study variables based on a sample size of 291 respondents. Overall, the results indicate that all variables recorded relatively high mean scores, suggesting generally strong levels of the constructs measured among participants.

Among the variables, Critical Thinking had the highest mean score ($M = 3.95$, $SD = 0.62$), followed closely by Research Competencies ($M = 3.89$, $SD = 0.64$) and Higher-Order Thinking ($M = 3.85$, $SD = 0.60$). This suggests that respondents demonstrated comparatively stronger abilities in analytical reasoning, research-related skills, and advanced cognitive processing.

Problem-Solving Skills also showed a high mean score ($M = 3.77$, $SD = 0.66$), indicating a relatively strong capacity to identify and address complex problems. Similarly, Innovation Capacity ($M = 3.58$, $SD = 0.68$) and Cognitive Dispositions ($M = 3.42$, $SD = 0.71$) recorded moderately high mean values, though they are slightly lower than the other constructs.

In terms of variability, the standard deviations across all variables are relatively low (ranging from 0.60 to 0.71), indicating a moderate level of consistency in respondents' perceptions and responses. Overall, the descriptive results suggest that while all constructs are positively rated, higher-order cognitive and research-related competencies are more pronounced than foundational cognitive dispositions and innovation capacity.

Furthermore, Pearson correlation coefficients were also computed to examine the relationship between the predictors and higher order thinking skills (HOTS). Table 2 shows that all the predictors have positive and significant correlations with HOTS. Critical thinking has the highest positive correlation with HOTS, followed by research competencies. The correlation matrix revealed that all the predictors have positive and significant correlations with higher order thinking skills (HOTS), with correlation coefficients ranging

from .51 to .61. Among the predictors, critical thinking has the highest positive correlation with HOTS, while cognitive dispositions have the lowest positive correlation with HOTS. Table 2 shows the results of the correlation matrix.

Table 2: Correlation Matrix of Predictors and HOTS

Variable	1	2	3	4	5	6
1. Cognitive Dispositions	1					
2. Innovation Capacity	.42**	1				
3. Research Competencies	.47**	.49**	1			
4. Critical Thinking	.44**	.46**	.52**	1		
5. Problem-Solving Skills	.41**	.43**	.48**	.55**	1	
6. Higher-Order Thinking	.51**	.53**	.59**	.61**	.57**	1

Source: Data Output from Statistical Package for Social Sciences (SPSS) version 26. (2026)

Furthermore, a multiple regression analysis was conducted to examine the predictive role of the independent variables in explaining higher order thinking skills (HOTS). Table 3 shows that the results of the multiple regression analysis revealed that the model has significant predictive role in explaining higher order thinking skills (HOTS). Furthermore, the results revealed that all the five predictors have significant roles in explaining higher order thinking skills (HOTS). Among the five predictors, critical thinking has the highest positive regression coefficient, followed by research competencies and problem-solving skills. On the other hand, cognitive dispositions and innovation capacity have smaller positive regression coefficients. Table 3 shows the results of the multiple regression analysis.

Table 3: Multiple Regression Predicting HOTS from Independent Variables

Predictor	β (Beta)	T	Sig. (p)
Cognitive Dispositions	.19	3.42	.001
Innovation Capacity	.15	2.98	.003
Research Competencies	.24	4.85	.000
Critical Thinking	.28	5.71	.000
Problem-Solving Skills	.21	4.12	.000

Source: Data Output from Statistical Package for Social Sciences (SPSS) version 26. (2026)

The model summary indicates that the five predictors: Cognitive Dispositions, Innovation Capacity, Research Competencies, Critical Thinking and Problem-Solving Skills, combined, account for more than half (54%) of the variance in higher-order thinking skills, which is a significant proportion. Among these predictors, critical thinking skills emerged as the most significant predictor of

higher-order thinking skills in the classroom, followed by research competencies and problem-solving skills, while cognitive dispositions and innovation capacity are also significant predictors but slightly lower in value. The high value of F and significant value of p confirm that the model is reliable and statistically sound. The summary of findings is as follows:

- I. The multiple regression model is statistically significant and accounts for 54% of the variance in higher-order thinking skills (HOTS) ($R = .74$, $R^2 = .54$, Adjusted $R^2 = .53$, $F = 42.73$, $p < .001$).
- II. All five predictors: Cognitive Dispositions, Innovation Capacity, Research Competencies, Critical Thinking, and Problem-Solving Skills are significant predictors of higher-order thinking skills.
- III. The predictor critical thinking skills emerged as the most significant predictor of higher-order thinking skills in the classroom ($\beta = .28$, $p < .001$), emphasizing its importance in enhancing higher-order thinking skills in students.
- IV. The predictors research competencies ($\beta = .24$, $p < .001$) and problem-solving skills ($\beta = .21$, $p < .001$) also emerged as significant predictors of higher-order thinking skills in the classroom.
- V. Cognitive dispositions (.19, $p = .001$) and innovation capacity (.15, $p = .003$) were significant, although to a lesser degree compared to the other variables.
- VI. Similarly, correlation analysis revealed that all the predictors were significantly, if moderately to strongly, correlated with HOTS. Critical thinking was found to have the strongest correlation with HOTS ($r = .61$), whereas cognitive dispositions were found to have the weakest correlation but still a significant one ($r = .51$).

Discussion

The findings of this study confirm that cognitive dispositions, innovation capacity, research competencies, critical thinking, and problem-solving skills are significant predictors of HOTS among postgraduate students of Sokoto State University. This finding supports the perspectives offered by Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001) and constructivist learning

theory (Piaget, 1972; Vygotsky, 1978) on the role of cognitive processes in achieving HOTS. Moreover, the findings of this study are consistent with more recent empirical studies suggesting that HOTS are not just a product of teaching strategies but are significantly influenced by learners' internal dispositions and skillsets (Brookhart, 2010; Zohar & Dori, 2012). This points to the need to develop more teaching models centered on metacognition, self-regulation, and reflection, which play a mediating role between learners' dispositions and HOTS.

Moreso, critical thinking was found to be the strongest predictor of HOTS, reinforcing previous research that analytical thinking and reflective judgment are crucial in postgraduate education (Ennis, 2018). This implies that students with the ability to analyze evidence and think critically about their assumptions are likely to succeed in tasks that require analysis and creative thinking. Furthermore, research competencies had a significant influence on HOTS, consistent with Levy and Ellis (2011), who posit that research competencies improve students' ability to generate new knowledge and apply it in problem-solving. This is in line with more recent research that recognizes critical thinking and research competencies as complementary forces in knowledge production and innovation in higher education (Bezanilla et al., 2019; Ku et al., 2021). This implies that postgraduate programs must incorporate critical inquiry and research competencies to enhance students' ability to think independently and make informed decisions.

Problem-solving skills also had a significant influence on HOTS, reinforcing Jonassen's (2014) argument that problem-solving activities help students to think cognitively and go beyond mere memorization of knowledge. Furthermore, cognitive dispositions such as curiosity and open-mindedness had a positive influence on HOTS, consistent with Facione et al. (1994), who highlight the significance of dispositions in sustaining intellectual inquiry in students. Innovation capacity was also found to have a significant effect on HOTS, consistent with Dyer et al. (2009), who highlight the significance of creative and innovative thinking in knowledge application in real-world contexts. More recent research reinforces the interconnectedness of problem-solving, dispositions, and innovation in enhancing students' ability to think cognitively and creatively, such that engagement with ill-structured problems enhances both cognitive flexibility and creative thinking (Mumford et al., 2012; Kim & Choi, 2025). This implies that developing HOTS in students is

more than merely teaching knowledge in a learning environment; it requires an environment that is likely to enhance students' ability to experiment, think flexibly, and creatively.

Overall, these results imply that HOTS among postgraduate students are multidimensionally influenced and can be enhanced through teaching and curriculum development. Significantly, by promoting HOTS, higher learning institutions can effectively prepare their students to contribute to the achievement of the Sustainable Development Goals (SDGs) in quality education (SDG 4), innovation (SDG 9), and strengthening institutions (SDG 16) in Nigeria and beyond. The general implication of this study is that higher learning in general needs to focus on the integration of cognitive, affective, and skill-based domains in instructional design (Halpern, 2014; Trilling & Fadel, 2009). By promoting HOTS in higher learning, not only can we improve individual learning outcomes but also contribute to societal development in terms of promoting innovation, good governance, and sustainability.

Implications of the Study

The implications of this study are that there is a need to design a postgraduate curriculum in Sokoto State University and other similar institutions in such a manner that higher-order thinking is enhanced by incorporating critical thinking, research competencies, and problem-solving skills in the curriculum. This is because critical thinking and research competencies emerged as the strongest predictors of HOTS in this study. As such, there is a need to go beyond knowledge acquisition in teaching and learning to incorporate evaluative and creative activities, such as those in Bloom's Revised Taxonomy. Furthermore, the significance of cognitive dispositions implies that there is a need to design teaching strategies in such a manner that students are encouraged to be curious, intellectually open, and to think and reflect, among other qualities. As such, lecturers in postgraduate classes should employ learner-centered strategies such as problem-based learning, case studies, and debates, among others, to help students think and act in a critical and creative manner, so that they internalize dispositions that enhance their intellectual growth.

The predictive effect of research competencies implies that there is a need to enhance research competencies in postgraduate classes in Nigeria, so that students are better equipped to conduct quality research, which in turn

enhances their higher-order thinking skills. Innovation capacity, which emerged as a significant predictor of HOTS, implies that there is a need to incorporate innovation-driven activities in postgraduate classes in Nigeria, so that students are better equipped to enhance innovation in Nigeria, which in turn enhances national development.

The role of problem-solving as a mediator implies that education should focus more on real-life problems that require critical thinking and creativity. This study has practical implications if postgraduate training guidelines in Nigeria are revised based on the findings. HOTS competencies should be strengthened as key graduate attributes. By ensuring that postgraduate training guidelines require alignment to critical thinking, research, and innovation, Nigeria's higher education policies can position universities to compete globally. This study has practical implications for Nigeria's contribution to achieving the SDGs. HOTS competencies can be leveraged to drive SDG 4: Quality Education, through innovation in education; SDG 9: Industry, Innovation, and Infrastructure, through research-based innovation; and SDG 16: Strong Institutions, through informed decision-making. This emphasizes the role of postgraduate training in achieving sustainable development.

This study emphasizes the need for institutions to provide support to students in developing HOTS competencies. Without such support, students may not be able to apply cognitive skills to practice. This may hinder students from contributing to development. Universities need to provide students with support such as research grants, access to virtual libraries, and innovation hubs to develop HOTS competencies.

In a knowledge-driven economy, higher-order thinking skills provide the predictors for global competitiveness among university graduates. By encouraging the development of these predictors, Nigerian universities can improve the chances of their products for successful participation in the global academic and professional communities. This suggests that universities like Sokoto State University need to adopt a global perspective in the design of their academic programs. Finally, the study highlights the importance of postgraduate education for the cultivation of lifelong learning dispositions. The cognitive dispositions and problem-solving skills of university graduates go beyond academic success to influence their lifelong growth and development. The cultivation of these dispositions and skills in university

graduates is essential for their ability to cope with future challenges and for national development.

Limitations of the Study

Although the study has offered significant insights into the subject, there are limitations to this study that need to be addressed.

Firstly, the study has been conducted on the population of postgraduate students in Sokoto State University; hence, the study cannot be generalized to other universities in Nigeria or in other countries.

Secondly, the study has been conducted using a cross-sectional research design; hence, the study has not been able to take into account the changes in the cognitive dispositions of the students, research skills of the students, and critical thinking skills of the students in Nigeria or in other countries.

Thirdly, the study has been conducted using self-report measures; hence, there is a possibility that the study might be influenced by a response bias in which the participants might overreport or underreport their skills and dispositions.

Moreover, although the study has focused on some of the significant predictors of innovation capacity, critical thinking skills, research skills of the students in Nigeria or in other countries, cognitive dispositions of the students in Nigeria or in other countries, problem-solving skills of the students in Nigeria or in other countries, there are other factors that might be significant in predicting the innovation capacity of the students in Nigeria or in other countries.

Lastly, the study has focused on the predictive relationship rather than a causative relationship; hence, even though the study has established significant predictive relationships between the variables, there is no way of ascertaining that these factors actually improve the innovation capacity of the students in Nigeria or in other countries.

Future Directions of the Study

Guided by the results and discussions in the study, the following are the proposed directions for future research to further enrich the knowledge on higher-order thinking skills (HOTS) for postgraduate students.

Firstly, it is proposed that future research employs longitudinal research designs to investigate the cognitive dispositions, critical thinking skills, research abilities, innovativeness, and problem-solving skills in postgraduate students. This research approach would offer more profound and robust insights into the dynamic and developmental nature of HOTS. Moreover, longitudinal research would allow researchers to investigate cause-and-effect relationships rather than predictive relationships.

Secondly, there is an urgent need to undertake comparative studies in various universities and regions within and outside Nigeria. This would enrich the study by enhancing the generalizability of the results. It would also reveal the role of contextual variables in the development of HOTS in postgraduate students.

Hence, it is proposed that future research employs mixed-methods research designs by combining quantitative data collection methods with qualitative methods. This approach would offer more profound and nuanced insights into the development of HOTS in postgraduate students. More specifically, mixed-methods research would reveal why critical thinking and research skills emerge as significant predictors of HOTS in postgraduate students.

Furthermore, experimental and quasi-experimental research designs are proposed to investigate the effectiveness of strategies to develop HOTS in postgraduate students. For instance, researchers could investigate the effectiveness of metacognitive strategies, inquiry-based learning, problem-based learning, and research-integrated curricula in enhancing HOTS in postgraduate students.

Further research into the following variables not covered in the present study may also be useful: digital literacy, socio-economic factors, learning technologies, emotional intelligence, and support systems. This will help construct a more comprehensive model for the development of HOTS in higher education.

Finally, future research may focus on the association between the development of HOTS and societal outcomes in the context of sustainable development goals (SDGs). This includes an exploration of the role of enhanced HOTS abilities in postgraduate students for the development of innovations and sustainable problem-solving in the real world.

Conclusion and Recommendations

This study was designed to examine the predictive influence of cognitive dispositions, innovation capacity, research competencies, critical thinking, and problem-solving skills on the development of higher-order thinking (HOTS) abilities among postgraduate students of Sokoto State University in Nigeria. The findings of the study revealed that all five predictors had a significant and positive influence on the development of higher-order thinking (HOTS) abilities among the participants. Critical thinking and research competencies emerged as the strongest predictors of the development of higher-order thinking (HOTS) abilities among postgraduate students of Sokoto State University in Nigeria. The findings of the study underscore the multi-dimensional nature of higher-order thinking (HOTS) abilities and the need for the inclusion of higher-order learning strategies in postgraduate education. The study also underscores the fact that the development of higher-order cognitive abilities is not only an academic necessity but also a developmental necessity for the future of Nigeria and the Nigerian people. The study concludes that higher-order cognitive abilities in postgraduate students will not only contribute to the academic development of Nigeria but also help the country achieve the sustainable development goals (SDGs) and become a competitive member of the global community. Fostering higher-order cognitive abilities in postgraduate students will not only help Nigeria become a competitive member of the global community but also help the country become a beacon of hope for the future and a source of sustainable development for generations to come. On the basis of the findings of the present study, the following recommendations are made:

- I. Postgraduate curricula should be reviewed to include more emphasis on developing higher-order thinking skills through the inclusion of critical thinking, research, and problem-solving exercises.
- II. Lecturers should use learner-centered approaches like problem-based learning, case studies, debates, and projects to promote critical thinking and creativity.
- III. Universities should provide workshops to enhance the research skills of postgraduate students in design, data analysis, and academic writing.

- IV. Universities should establish innovation hubs, incubation centers, and research platforms to promote innovation and entrepreneurial thinking in students.
- V. Assignments and assessments should be based on actual problems, allowing students to apply their cognitive skills to solve actual problems in society and national development.
- VI. Higher education policy in Nigeria should be designed to include higher-order thinking skills as graduate attributes to ensure uniformity and quality.
- VII. Universities should prioritize the provision of digital libraries, international journals, research grants, and other learning technologies to enhance cognitive skills.
- VIII. Postgraduate education should include a connection to the SDGs to ensure students understand the importance of cognitive skills to national and international development.

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Assessment of Farm Hawking among Female Teenagers in Sokoto Central Constituency, Sokoto State

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Abstract

The paper investigated on Farm hawking among teenage girls in Sokoto Central Constituency, Sokoto State. Descriptive survey design were employed. 227 teenage farm hawkers were purposively selected as participants representing the entire population of the study. Self-developed questionnaire was used to elicit responses and data collected were analysed using SPSS version 20. Descriptive statistical tools of frequency and percentage were used to analyse the data. The finding revealed that, parental economic constraint, low level of education and in ability of the parent to enroll them in school were the remote causes of farm hawking among the female teenagers. The finding also shown that farm hawking result to high rate of delinquency, moral laxity and expose female teenagers to early sexual activities. And it was finally recommended that, parent should endeavor to dedicate their resources in training and educating girl child to avoid living them standardly hawking around farms at their risk. It was also recommended that to address social effects of farm hawking, entrepreneurship training should be provided and encouraged among female teenagers for individual, communal and national growth.

Keywords: Female Teenagers, Farm Hawking, Sokoto Central Constituency

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Introduction

Apart from the high death rate recorded as a result of COVID-19 disaster, the Pandemic also accelerated the existing challenges affecting people in Nigeria particularly in the Northern part of the country. Some of these problems are; insecurity, street bagging, street hawking, high rate of farm hawking, child labour teenage prostitution and widen more gap between “the have and have not”. The above mentioned problems indicated that children and teenagers are the major victims and are as well the most vital section of any population for future planning.

Despite the United Nation Children Education Fund (UNICEF) and Girl Education Project (GEP) and Nigeria Enhancing Girl Basic Education in Nigeria (ACTIONAID) to minimize child abuse like hawking at the expense of literacy and skills acquisition, about 121 million children are out of school, 65 million girls and 80 percent from Sub Sahara Africa (UNICEF, 2017). Many of these girls are sending out of school in to the streets and farms to ‘hawk’ goods or other form of economic activities to support the family income. Hawking among children is regarded as a tradition in sub-Sahara Africa. It cuts across every section of the society regardless of gender. In Nigeria, particularly northern states hawking has become the major mean of income earning among the lower and some middle class families.

In Sokoto Central constituency consisting of Sokoto North, Sokoto South, Wamakko, Kware Binji Silame, Tangaza and Gudu local government areas , Sokoto State. , the common forms of hawking are street and farm hawkings. The worrisome aspect of this menace is the involvement of the significant number of teenage school-age girls causing more social and psychological problems than it solves. As a result of this ugly trend, their holistic development is at high risk and their fundamental human rights as citizens are abused and jeopardized.

Farm hawking refers to the act of canvassing for sale of items carried by the hawkers from farm to another farm or under the trees where farmers dry their sweat. Teenagers particularly girls troop down the valley on daily bases carrying wares of mostly “Fura da Nono” (commonest traditional food made from millet) moving from one farm to others selling their wares. Farm hawking prove to be more vulnerable than street hawking because of the isolation and privacy the hawkers and their customers enjoy from various

covers produced by crops in the farm in addition to the existing covers of trees and shrubs in the valley. Farm hawking also exposed the teenage girls to criminal hide-out in the valley where many were either raped, initiated into notorious group and some are being introduced into prostitution all in the name of hawking. Occasionally, hawkers suffer loss of money or food items in the hand of such criminals during or after sells. Moreover, many tugs or criminals sexually abused farm hawkers since shouting and crying are of less used for people's help in the bush. The constituency and its subordinate villages are located on the anticline of the Rima U-shaped valley where agricultural activities are taking place throughout the year.

History revealed that hawking is one of the oldest commercial activity that has come to be a dominant trend even in the modern day society (Abari, 2013). This is a very common trend across Nigerian societies from rural communities to urban centers. It is indeed the most common economic activity in the rural communities of northern Nigeria. For example, it is easy to see teenage Fulani girls moving about the streets hawking cow milk (Lantana, 2010). While other girls hawk different items like groundnut, water, yam and other food commodities by the major highways. For example, a potential bride whose parents are poor must hawk in order to get the money required to buy for her what she should be taking to her husband's house, such as bed, food, and other elegant items (Lantana, 2010).

The research on farm hawking among girl child conducted by Nawait, et al. (2020) revealed that the consistency of farm hawking among teenage girls in Dundaye district was largely caused by home-based factor and farm hawking which have both social and psychological effects of the teenage girls, including exposure to early sexual activities and high rate of truancy. The present study is specifically on farm hawking as hundreds of thousands of school aged teenagers are found to be patronized on daily basis. The main focuses are to identify the causes and effects of farm hawking among these vulnerable set of people in the study area.

Objectives of the Study

The objectives of the study are to:

- I. Find out the remote causes of farm hawking among female teenagers in Sokoto Central Constituency, Sokoto State.

- II. Identify Social effects of farm hawking on female teenagers in Sokoto Central Constituency, Sokoto State.

Research Questions

The following research questions were used as guide to the study;

- I. What are the remote causes of farm hawking among female teenagers in Sokoto Central Constituency, Sokoto State?
- II. What are the social effects of farm hawking on female teenagers in Sokoto Central Constituency, Sokoto State?

Methodology

The research design used descriptive research which involves the use of questionnaire to get information from the target population. The target population of the study comprise of all the female teenagers in Sokoto Central constituency (Sokoto North, Sokoto South, Wamakko, Kware Binji Silame, Tangaza and Gudu local government areas), Sokoto State, but specifically those hawking within the Rima valley cutting across the above-mentioned local government areas.

The population of hawkers are not stable because they wander about looking for their customers. The inhabitants of the area were predominantly of the Hausa/Fulani ethnic group and they are mostly farmers of all categories. A large proportion of the inhabitants are farmers and traders, with few artisans and civil servants.

The sampling designs used was multi-stage, because the study was purposely or judgmentally sampled. Judgment was used in selecting the area as a case study with specific purpose (area with teenage hawkers) in mind (Neuman, 2003). The study also used the convenience sampling or accidental sampling to select the teenage hawkers that will participate in the study.

The sample size depended on the total accessible teenage hawkers identified with help of Research Average (2006) table of sample size in order to arrive at appropriate size. The questionnaire named Teenage Farm Hawkers Questionnaire (TFHQ) will be used to elicit information from teenage hawkers with the help of Six (6) Research assistants; One for research assistant par local government area. See attach at (Appendix I). The data was collected

through direct contact between the Researcher, Six Research assistants and the respondents. Each research assistant will cover two local government areas since the distribution of questionnaires involve tracking down through the Rima river valley where hawking business is usually taking place. Data collected from the respondents was processed and analyzed with the help of Special Package for Social Science (SPSS) Version 20 using percentage frequency and mean to provide answers to the research questions.

Findings

What are the remote causes of farm hawking among female teenagers in Sokoto Central Constituency, Sokoto State?

Table 1: Causes of Farm Hawking

S/N	Item	Agree F (%)	Disagree F (%)
1	Children hawk around farms because there are not enrolled in formal school (Boko).	218 (96)	9 (4.0)
2	Farm hawking is influenced by parental economic background	216 (95.2)	11 (4.8)
3	Farm hawking is influenced by parental educational background	226 (99.6)	1 (.4)

Source: Field Data

Results presented in table one shows the causes of farm hawking among teenage girl-child in Sokoto Central Constituency, Sokoto State. Item one of the Table 1 shows that the 96% of the respondents agreed that children hawk around farms because they were not enrolled in formal system of education; this submission was countered by only 9% who disagreed. On item two, 95% affirmed that children hawk around the farm to get money because of their parent economic constrain only 11% disagreed with the statement. While the in respond to the last item 99% submitted that children hawk because of their parent negative perceptions toward education.

What are the social effects of teenage Farm hawking among girl-child in the Sokoto Central Constituency?

Table 2: Social Effects of Farm Hawking

S/N	Item	Agree F (%)	Disagree F (%)
1	Farm hawking influences the high rate of delinquency	224 (98.3)	3 (1.3)
2	Farm hawking influences the high rate of moral laxity	196 (86.3)	31 (13.8)
3	Children that hawk around the farm are exposed to early sexual activities	203 (89.4)	24 (10.6)

Source: *Field Data*

Table 2 presents the social effects of farm hawking among teenage girl-child in the constituency. Item one of the Table shows that 98% of the respondents agreed that farm hawking influence high rate of delinquency only 1.3% disagreed. In item two, 86.3% responded in favour of the item that farm hawking influences high rate moral laxity only 13.8% disagreed. However, in the last item 89.4% agreed that farm hawking exposes girls to early sexual activities, only 10.6% disagreed with the statement. It can therefore be concluded that farm hawking lead to high rate of delinquency, moral laxity and expose them to early sexual activities.

Discussion

This study investigates the effect of farm hawking among teenage girls in the senatorial, Participants involved 227 teenage girls who hawk around the farms. Findings of the study were presented and discussed in accordance with the research questions.

Research question one revealed that the causes of farm hawking among girl-children in the Constituency include: parental economic constraint, low level of education and inability for them to be enrolled in schools. While acknowledging these causes, the finding that farm hawking stemmed from the inability for the girls to be enrolled in school is misleading owing to the fact that of the respondents submitted that they were enrolled in secular school. However, overall, the findings does establish that farm hawking are caused mainly by home factors. In support of this assertion, Ebgbo (2003) contended that while poverty is often postulated as the principal cause of forcing children into labour, lack of social services at home, lack of good housing, inadequate food and health care service, have been known to compel parents to send their children into street hawking and child labour. Other factors considered to cause farm hawking were put forward by Fawole et al. (2003) who contend that these factors include poverty, high cost of living, lack of sponsorship,

poor school performance, single parenthood, large family size, peer group pressure, poor home conditions, lack of parental care, parents' unemployment, parental pressure, poor scholastic achievements. Appel (2009) has identified structural inequalities as the cause of child hawking, while Nwabueze (1992) sees poverty and inequality as the major causes of child hawking and child labour. This concludes that farm hawking stems from domestic factors, which needs to be solved holistically.

Findings from research question two revealed that farm hawking lead to high rate of delinquency, moral laxity and exposed teenagers to early sexual acts. These are social effects that need to be treated with urgent concern. In support of this finding, Onuzulike (2007) found that unwanted pregnancies, prostitution, smoking, robbery, truancy and poor academic performance are among social effects of child hawking amond. He concluded that street hawking does not endanger only the lives of the hawkers, but also the food hawked and the consumer society at large. As put forward by Korbin (1983), socially, children can experience negative effects on their educational development and performance. Illiteracy, low school attendance, and low enrolment have developmental and performance implication and have been attributed to children's economic participation. These empirical evidences affirm the present finding that teenage hawking around the farms expose them to social vices.

Conclusion

Based on the findings of the study, it was concluded that the consistent farm hawing among teenage girls in the Constituency was largely caused by home-based factors. Furthermore, farm hawking has social effects of the teenage girls, including exposure to early sexual activities and high rate of moral laxity.

Recommendations

Based on the outcome of the study the following recommendations were made;

- I. Parent should endeavor to enroll their children in both Islamic and western systems of education for better and brighter future.

- II. Parents are urged to desist from exposing their teenage girls to farm hawking. Although, due to persistent socio-economic status, they can engage their kids in domestic entrepreneurship programmes for future benefits.

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Awareness, and Utilization of Artificial Intelligence (AI) Among Public Secondary School Counsellors in Sokoto Metropolis, Sokoto State, Nigeria

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Abstract

This study examined the awareness and utilization of Artificial Intelligence (AI) among public secondary school counsellors in Sokoto Metropolis, Sokoto State, Nigeria. The study adopted a descriptive survey research design and the population comprised 126 counsellors from public secondary schools in Sokoto Metropolis, while 40 respondents were selected using a stratified random sampling technique. A structured questionnaire titled “Counsellors’ Awareness and Utilization of Artificial Intelligence (CAAUIQ)” was used for data collection. The instrument was validated by experts in education and pilot tested on 30 counsellors, teachers, and administrators outside the study area, yielding a reliability index of 0.87. Data collected were analyzed using descriptive and inferential statistics. The findings revealed a strong positive and statistically significant relationship between counsellors’ level of AI awareness and their extent of AI utilization. The results further showed significant differences between counsellors’ awareness and utilization of AI in counselling practices, and in their perceptions of the benefits of AI adoption based on demographic factors such as gender, years of experience, and school type. The study recommended that the Ministry of Education and school management should organize continuous professional development workshops and seminars to enhance counsellors’ knowledge, awareness, and competencies in AI tools. Educational authorities should ensure adequate provision and accessibility of AI-based counselling technologies, while institutions should establish mentorship systems for effective peer learning.

Keywords: Artificial Intelligence, Awareness, Utilization and AI Adoption

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Introduction

First and foremost, the integration of AI in educational counselling represents a particularly promising frontier, offering opportunities to revolutionize how school counsellors support student academic, career, and personal-social development. AI-powered tools can assist counsellors in various capacities, including student assessment and screening, personalized intervention recommendations, resource allocation optimization, and data-driven decision making (Goksel & Bozkurt, 2019). Furthermore, AI technologies such as chatbots and virtual assistants can provide 24/7 student support, supplement counsellor availability, and enhance accessibility to counselling services.

Therefore, Nigeria, as Africa's most populous nation with over 200 million people, faces significant challenges in providing adequate educational support services, particularly in the area of school counselling. The country's educational system serves millions of students across primary, secondary, and tertiary levels, yet the counsellor-to-student ratio remains inadequate to meet the growing demand for guidance and counselling services (Adeyemo, 2020). This situation is particularly acute in northern states like Sokoto, where educational infrastructure and human resources often lag behind national averages.

Awareness serves as the foundation of the framework. Counsellors' knowledge and understanding of AI concepts, tools, and applications influence their readiness to consider AI as part of professional practice. Without awareness, other variables cannot be meaningfully engaged.

Utilization: is the outcome variable, reflecting the actual integration of AI into counselling practice. It depends on the interaction of the other three variables: counsellors must first be aware of AI, have access to available tools, and hold positive perceptions of AI's benefits before utilization can occur at scale.

Additionally, the Technology Acceptance Model (TAM) provides a theoretical framework for understanding how individuals adopt new technologies, emphasizing the roles of perceived usefulness and perceived ease of use in determining technology acceptance and utilization (Davis, 1989). This model, along with Diffusion of Innovation Theory, offers valuable insights into the factors that influence AI adoption among school counsellors of Sokoto metropolis Sokoto state, Nigeria.

In Sokoto State, and specifically in Sokoto metropolis, anecdotal observations suggest that most public secondary school counsellors rely predominantly on traditional counselling methods such as face-to-face sessions, manual record keeping, and paper-based guidance materials. The degree to which they are aware of AI tools, the extent to which they utilize them, and their perceptions of the benefits and challenges of AI adoption remain largely undocumented, this gap is concerning because counsellors are key agents of student support, and their effectiveness could be enhanced by AI-based tools that provide accurate, timely, and individualized services.

Mutisya and Rotich (2021) examined “Integration of Artificial Intelligence Applications in Kenyan Secondary Schools: Teachers’ Awareness and Challenges.” The study aimed to establish the awareness and challenges teachers face in adopting AI applications for teaching. Findings revealed that teachers were moderately aware of AI but reported low levels of utilization due to poor availability of tools, inadequate training, and policy gaps.

Olayemi and Olawale (2020) carried out a study titled “*Teachers’ Awareness and Readiness for Artificial Intelligence Integration in Secondary Education in Nigeria.*” The purpose was to investigate teachers’ awareness, readiness, and challenges towards AI adoption in classrooms. Findings showed that while most teachers were aware of AI concepts, their readiness and utilization were low, primarily due to unavailability of AI tools and lack of training. The study concluded that awareness without availability and training cannot lead to utilization.

Adu and Adetimirin (2019) carried out a study titled “*ICT Awareness and Use for Teaching among Pre-Service Teachers in Nigerian Universities.*” The purpose was to examine awareness and utilization of ICT resources for academic work among future teachers. Findings revealed that while ICT awareness was high, actual utilization was limited due to poor infrastructure and inadequate institutional support. The study concluded that infrastructural availability influences utilization, not just awareness. It recommended improved ICT infrastructure and training to enhance ICT adoption. Its strength lies in directly linking awareness to utilization, which aligns with the focus of this dissertation. Its weakness, however, is that it addressed general ICT rather than AI-specific tools and excluded the counselling context.

Afolabi and Olatunji (2020) conducted a study titled “*Teachers’ Perception and Awareness of Artificial Intelligence in Secondary Education in Oyo State, Nigeria.*” The purpose was to examine awareness levels and perceived benefits of AI adoption. Findings revealed moderate awareness of AI concepts but limited understanding of its applications in teaching and counselling. Teachers perceived AI as beneficial for personalized learning but expressed concerns about job displacement. The study concluded that awareness must be deepened for effective AI integration.

Furthermore, the literature reveals a research gap: while there are global and national studies on AI in education, very few studies have focused on school counsellors in Nigeria, particularly in Northern states such as Sokoto. Most available research tends to emphasize ICT use in teaching and learning (e.g., Yusuf & Oyediran, 2021) rather than its adoption in counselling services. This creates a critical vacuum in knowledge for policymakers and practitioners who need evidence-based insights on how to support counsellors in AI integration.

The absence of localized studies has practical consequences. Without empirical data on counsellors’ awareness, training needs, utilization, and perceptions of AI, Sokoto State risks missing opportunities to align school counselling services with global technological trends. This could perpetuate existing challenges such as poor student guidance on career paths, inefficient record-keeping, limited access to psychosocial support, and the inability to meet students’ evolving needs in a digital society.

Therefore, this study is necessary to fill the gap by systematically investigating the awareness, utilization, training and support needs, as well as perceptions of AI adoption among public secondary school counsellors in Sokoto metropolis. The findings will provide relevant insights for policymakers, educational planners, and stakeholders to design targeted interventions that bridge the gap between policy intentions and practice, ultimately enhancing the quality of guidance and counselling services in Nigerian schools.

Objectives of the Study

The following research Objectives were formulated as guide to the study:

- I. Examine the current level of AI awareness among public secondary school counsellors in Sokoto metropolis.

- II. Examine counsellors' perceptions of the benefits of AI adoption in school counselling.

Research Questions

The following research questions were formulated as guide to the study;

- I. What is the current level of AI awareness among public secondary school counsellors in Sokoto metropolis?
- II. What are the counsellors' perceptions of the benefits of adopting AI in school counselling?

Methodology

The study employed a descriptive survey research design. The design is considered appropriate because the study seeks to obtain factual information from a representative sample of public secondary school counsellors on their awareness, availability, and utilization of artificial intelligence (AI) in Sokoto metropolis. The target population of the study comprised of all public secondary school counsellors in Sokoto metropolis, Sokoto State, Nigeria. According to the Sokoto State Ministry of Education (2024), there are approximately 42 public secondary schools within Sokoto metropolis, each having at least one designated counsellor, making the estimated population of counsellors 42.

The study employed a stratified random sampling technique, ensuring representation across gender, years of experience, and school location (urban and peri-urban). This method is chosen to enhance the generalizability of findings and reduce sampling bias.

The study used a structured questionnaire as the main instrument for data collection. The reliability of the instruments was established through a pilot study. 30 questionnaire was administered twice to counsellor, teachers, and administrators to schools in Kebbi State at a two-week interval. The correlation coefficient between the test and re-test was $r = 0.862$, was obtained.

The data collected was analyzed using both descriptive and inferential statistics: for Descriptive statistics (mean, frequency, percentage, and standard

deviation) was used to answer the research questions. And for Inferential statistics such as Chi-square test of independence and t-test was employed to test the research hypotheses at 0.05 level of significance.

Result

Research Question One: What is the current level of AI awareness among public secondary school counsellors in Sokoto metropolis?

Table 1: Current level of AI awareness among public secondary school counsellors in Sokoto metropolis

S/no	Item Statement	SA	A	D	SD	Mean	Std. Deviation
1	I am aware of what Artificial Intelligence (AI) means in the context of education.	20	11	5	4	3.18	1.010
2	I know how AI can be applied in school counselling practices.	24	12	1	3	3.43	.874
3	I am aware of specific AI tools used in counselling (e.g., predictive analytics, adaptive learning software)	24	11	2	3	3.40	.900
4	I have received training or orientation on the use of AI in counselling.	23	11	4	2	3.38	.868
5	I am familiar with how AI can assist in identifying students' academic, career, and emotional needs.	21	12	4	3	3.28	.933
	Grand Mean					3.33	.917

Key: Strongly Agree =SA, Agree = A, Disagree =D, Strongly Disagree =SD

Source: Fieldwork, 2025

Decision Rule: In this analysis the critical mean is 2.50 by this definition, any descriptor statement for which a mean score of more than 2.50 is observed denotes agreement of the respondents to what statement curelessly, for any descriptive statement for which a mean score of less than 2.50 is observed is an indication of disagreement respondents to that statement.

Table 1 shows the current level of AI awareness among public secondary school counsellors in Sokoto metropolis. Looking at the results, item 1 was in agreement that they aware of what Artificial Intelligence (AI) means in the context of education with a mean score of 3.18 which is greater than critical mean of 2.50. In item two was in agreement that they know how AI can be applied in school counselling practices with a mean score of 3.43 which is greater than the critical mean of 2.50. Whereas item 3 was in agreement that they are aware of specific AI tools used in counselling (e.g., predictive analytics, adaptive learning software) with a mean score of 3.40 which is greater than the critical mean of 2.50. Item 4 was in agreement that they have received training or orientation on the use of AI in counselling with a mean

score of 3.38 is greater than the critical mean of 2.50. Item 5 was in agreement that they are familiar with how AI can assist in identifying students' academic, career, and emotional needs with a mean score of 3.28 which is greater than the critical mean of 2.50. The above analysis implies that, majority of the respondents were in agreement that there is a high level of AI awareness among public secondary school counsellors in Sokoto metropolis with a grand mean of 3.33 against a critical mean of 2.50.

Research Question Two: What are the counsellors' perceptions of the benefits of adopting AI in school counselling?

Table 3: Counsellors' perceptions of the benefits of adopting AI in school counselling

S/no	Item Statement	SA	A	D	SD	Mean	Std. Deviation
1	AI can improve the accuracy of diagnosing students' needs.	23	9	5	3	3.30	.966
2	AI reduces the workload of counsellors and saves time.	24	8	4	4	3.30	1.018
3	AI enhances student career decision-making processes.	22	11	4	3	3.30	.939
4	AI strengthens counsellors' ability to provide personalized guidance.	21	10	4	5	3.18	1.059
5	AI has the potential to complement, rather than replace, the role of human counsellors.	20	13	4	3	3.25	.927
	Grand Mean					3.26	.981

Key: Strongly Agree =SA, Agree = A, Disagree =D, Strongly Disagree =SD

Source: Fieldwork, 2025

Decision Rule: In this analysis the critical mean is 2.50 by this definition, any descriptor statement for which a mean score of more than 2.50 is observed denotes agreement of the respondents to what statement curelessly, for any descriptive statement for which a mean score of less than 2.50 is observed is an indication of disagreement respondents to that statement.

Table 4 shows the counsellors' perceptions of the benefits of adopting AI in school counselling. Looking at the results, item 1 was in agreement that AI can improve the accuracy of diagnosing students' needs with a mean score of 3.30 which is greater than critical mean of 2.50. In item two was in agreement that AI reduces the workload of counsellors and saves time with a mean score of 3.30 which is greater than the critical mean of 2.50. Whereas item 3 was in agreement that AI enhances student career decision-making processes with a mean score of 3.30 which is greater than the critical mean of 2.50. Item 4 was in agreement that AI strengthens counsellors' ability to provide personalized

guidance with a mean score of 3.18 is greater than the critical mean of 2.50. Item 5 was in agreement that AI has the potential to complement, rather than replace, the role of human counsellors with a mean score of 3.25 which is greater than the critical mean of 2.50. The above analysis implies that, majority of the respondents were in agreement that there is a level of importance of counsellors' positive perceptions toward the benefits of adopting Artificial Intelligence (AI) in school counselling." with a grand mean of 3.26 against a critical mean of 2.50.

Discussion

This study examines awareness, and utilization of artificial intelligence (AI) among public secondary school counsellors in Sokoto metropolis, Sokoto State, Nigeria. Results were discussed in accordance with the research hypotheses as presented below;

The findings from null hypothesis one (H_{01}) reveal a strong positive and statistically significant relationship between counsellors' level of AI awareness and their extent of AI utilization. This implies that counsellors who possess higher awareness of artificial intelligence tools and their potential applications in school counselling tend to utilize these technologies more effectively in their professional practice. The finding connotes that knowledge and familiarity with AI concepts enhance confidence, competence, and readiness to integrate AI into counselling processes such as data management, career guidance, and emotional assessment. In essence, awareness serves as a precursor to adoption and usage, suggesting that counsellors who understand the benefits and functions of AI are more inclined to leverage it to improve counselling efficiency and outcomes.

This finding corroborates the submission of Viberg *et al.* (2023), that educators' awareness of emerging technologies strongly predicts their intention and willingness to integrate them into teaching and learning practices. Their study emphasized that awareness influences both perceived usefulness and ease of use, which are crucial determinants of technology adoption according to the Technology Acceptance Model (TAM). Similarly, Wang *et al.* (2023) reported that school counsellors with higher technological literacy exhibit greater readiness to employ AI-based applications such as predictive analytics and chatbots for student support services. These studies collectively reinforce the idea that awareness is not just informational but transformational it shapes attitudes, builds digital competence, and directly

enhances the practical use of technology in educational guidance and counselling contexts.

Furthermore, the result aligns with the scholarly view of An *et al.* (2023), who posited that the depth of AI awareness among professionals determines the extent of AI-driven innovation within their work environments. They argued that awareness fosters proactive engagement with technological tools, enabling professionals to adapt to the evolving digital landscape. This supports the current finding that counsellors' awareness levels significantly predict their degree of AI utilization. Therefore, the present result integrates with existing literature by confirming that promoting AI awareness through training, workshops, and policy support can substantially enhance the adoption and effective application of AI in school counselling practices. This alignment underscores the critical role of awareness-building initiatives in strengthening counsellors' technological competence and improving the quality of guidance and counselling services in educational institutions.

The findings from null hypothesis two (H₀₂) revealed that there is a significant difference in counsellors' perceptions of the benefits of AI adoption based on demographic factors such as gender, years of experience, and school type. This finding connotes that demographic characteristics play a crucial role in shaping how counsellors view and appreciate the usefulness of AI tools in school counselling. It suggests that differences in exposure, technological familiarity, and institutional environments may influence how various groups of counsellors perceive AI adoption. This aligns with the view of Usman and Bello (2022), that demographic variables, especially gender and years of professional experience, significantly affect educators' acceptance and perception of digital innovations. Hence, the observed difference underscores the need to consider demographic diversity when designing AI-related professional development and capacity-building programmes for counsellors.

Furthermore, this finding corroborates the submission of Afolabi and Olatunji (2020), who found that counsellors' perceptions of emerging technologies are shaped by their workplace setting and experience level. Their study showed that counsellors in urban and technologically advanced schools exhibit more positive attitudes toward AI adoption than those in rural or resource-constrained schools. Similarly, younger counsellors or those with less professional experience tend to show greater enthusiasm for integrating AI tools than their older counterparts, who may be more accustomed to traditional

counselling approaches. This supports the idea that experience and institutional context mediate the extent to which counsellors appreciate the potential benefits of AI, highlighting the need for equitable access to digital infrastructure and inclusive training opportunities across school types.

In addition, the finding integrates and supports the ideas of Yusuf and Ibrahim (2021), who argued that perceptions toward technological innovations in educational settings are not uniform but are influenced by socio-demographic and contextual factors. They maintained that gender dynamics, professional exposure, and organizational culture collectively determine the level of acceptance and perceived benefits of AI among educators and counsellors. In this regard, the significant difference found in this study validates the assertion that demographic factors must be considered when implementing AI adoption strategies in schools. Therefore, the result contributes to the growing body of evidence that individualized and context-sensitive approaches are essential for fostering inclusive and effective AI integration in counselling practices.

Conclusions

Based on the findings of the study, it can be concluded that the integration of Artificial Intelligence (AI) into school counselling practices is significantly influenced by counsellors' level of awareness, access to AI tools, and demographic characteristics. The strong positive and statistically significant relationship between counsellors' awareness of AI and their extent of utilization underscores the importance of knowledge and exposure as key determinants of effective AI application in counselling

Recommendations

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

- I. The Ministry of Education and school management organize continuous professional development workshops and seminars aimed at improving counsellors' knowledge, awareness, and competencies in the use of Artificial Intelligence (AI) tools. This will enhance their confidence and effectiveness in integrating AI into counselling practices.

- II. Policymakers should promote inclusive training programs that consider these demographic differences, ensuring equitable opportunities for all counsellors to adopt and benefit from AI-driven counselling practices.

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Assessment of Self –efficacy level and Challenges of Preservice Biology Teachers towards YouTube Tutorials for Learning Procedures and Skill of Improvising Models of Biological Structures

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Abstract

This study aimed at assessing the self –efficacy level and challenges of preservice biology teachers towards YouTube tutorials for learning procedures and skill for improvising models of biological structures. 196 preservice biology teachers of the Department of science education, Sokoto State University were selected to represent the population of 285. The Samples were selected using proportionate sampling technique. The study used two instruments for data collection. Biological Model Development Self-Efficacy Questionnaire (BMDSQ) and open-ended Interview schedule. Data collection lasted for three days and activities such as watching and downloading videos of YouTube tutorials demonstrating how to create some models of biological structure such as plant cell, animal cell and human digestive system. Data generated from the BMDSQ was analysed using mean to answer research questions one. The data obtained from the interview was analysed using thematic analysis. Findings of the study revealed that, preservice biology teachers are moderately confident of creating accurate and simple models of plant cell, animal cell and human digestive system, after watching YouTube videos demonstrating how to create the models. poor internet connection and high cost of data, language barrier / Ascent variation, non-availability and affordability of improvisation materials and distractions are the challenges associated with learning through YouTube tutorials.

Keywords: Self –efficacy; Preservice Teachers; YouTube; Improvising and Biological Models

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Introduction

Biology is regarded as the simplest and less abstract natural science discipline which studies the entirety of living matter. This has made it a wide subject area with many branches. The vision of every biology teacher was to guide the learner acquire knowledge of biological concepts, to enable him develop interest in the area. To achieve this, adequate and suitable instructional materials must be provided to aid the learning processes. The importance of these materials in learning biology cannot be overemphasized. Instructional materials are regarded as resources used by the teacher to help him clearly explain the topic or content to the learner so that he can understand (Tukur, 2012). These materials are basically categorized as; audio, visual and audio-visual. In biology instruction, most of the instructional materials used are visual in nature, they include real objects (specimens), Models objects, charts and photographs. Visual materials like specimens are often preferred in any biology classroom, they give the learner the opportunity to observe them in their real form, shape and study their major features. However, some biological specimens are dangerous and inappropriate to be used by the learners, hence, the rationale for developing and using their model structures to facilitate learning.

In Nigerian schools today, most of the model structures available in biology laboratories are industrial made which are too expensive and difficult to obtain by classroom teachers. Therefore, it is imperative to equip the preservice biology teachers with the skills and know-how about the production or improvisation of models for effective biology (Sayen & Mertoglu, 2020). Models according to Advance learners' dictionary refers to a copy of something or 3-dimensional representations of object or structure. Svoboda and Passmore, (2013) viewed models as representations that describe phenomena which helps in the communication of ideas. In Biology, models are used as tools in scientific inquiry, research and communication (instruction), to explain ideas or processes occurring in the natural world. The models used in biology education are either physical or computer models. Physical models can be seen and touched while computer models can only be seen and manipulated on the screen, but it cannot be touched. Concrete (physical) scale models such as a model of a skeleton are among the most commonly used in secondary school biology education (Jansen et al, 2019). Loucas et al, (2011) reported that models improved students' understanding of

concepts and their operations. Robles-Moral et al, (2023) reported that preservice teachers prefer to use physical model than digital models, probably because it was closer to a real situation and more easily understood by pupils

The teacher plays a significant role in the curriculum implementation by making informed decisions on the content to teach from the curriculum using appropriate instructional materials. Teachers are mainly categorized into two; in-service and preservice teachers. An inservice teacher is an individual who completed a teacher education programme and is already teaching in the classroom. A preservice teacher on the other hand relates to an individual who is undertaking a teacher education programme at college or bachelor degree level, learning instructional practices, content knowledge and classroom management. Ibrahim (2023) identified the difference in the preference of learning style among the preservice teachers among the needs of preservice teachers that need to be tackled by teacher training institutions in Nigeria, he opined that some preservice teachers prepare lecture using audio-video aids while others prepare normal lectures without use of teaching aids. This suggested that teachers of today must be prepared and developed to be relevant in the new classroom, by improving their knowledge, skills and competency in the use of emerging technologies for their teaching processes (Mormah and Bassey, 2021).

YouTube was founded in 2005 and becomes an important instructional tool or approach in the 21st century with a profound and significant impact on education. Existing literature shows that YouTube provides the learner with the opportunity to revise content severally, learn in any language, learn single topic from different sources or instructors. and avoid scheduled time table of classroom. The use of video-based instructional approaches such as YouTube arouses the level of Nigeria's students' interest in Biology (Edache-Abah, & Dike, 2019). Ogirima et al, (2021). Studied the Preservice teachers' perception on the use of YouTube for teaching-learning activities in Nigerian basic schools. The study used descriptive survey research design involving 200 purposively selected preservice teachers, Future Teachers' Perception towards the Use of YouTube Questionnaire (FTPUYQ) was used for data collection. Findings of the study reported a high perception for the use of YouTube in teaching-learning activities in Nigerian Basic schools among preservice teachers. In addition, the study reported that preservice teachers unanimously indicated a high level of ease of using YouTube for teaching-learning activities in Nigerian Basic Schools

The theoretical basis of these studies are Albert Bandura's theories of social cognitive learning and self-efficacy. The social cognitive learning theory hypothesized that learning occurs through observation, imitation and reinforcement. This position suggested that one can acquire knowledge and skill by observing and imitating others. The implication of this theory to this study is that preservice biology teachers can acquire basic knowledge and skills for developing models of biological structures through watching Youtube video tutorials on developing such structures. The self-efficacy theory on the other hand explains how psychological processes (learning, thinking, perception, motivation etc.) alter people's level and strength of a person's belief in his ability to perform a task or achieve a goal. Accordingly, the theory highlighted four sources through which these psychological processes influence learning, through successful performance of a task, vicarious experience, verbal persuasion and physiological state. Therefore, this theory posits that learning influences a person's belief in his ability when he or she is able to achieve success, observe others, receive feedback and encouragement from others. This implies, the self-belief of preservice biology teachers to develop models of biological structures can be altered through watching videos of other people developing such models.

Objectives of the Study

The main objective of the study was to assess the influence of YouTube tutorials on the self-efficacy level of preservice towards improvising models of biological structures. To achieve this objective, the following objectives were set for the study:

- I. To find out the self-efficacy level of preservice biology teachers to create models of plants and animal cells and human digestive system after using You Tube tutorials
- II. To find out the challenges that may hinders the use YouTube tutorials in learning procedures and skill for improvising models of biological structures among preservice biology teachers

Research Questions

Based on the aforementioned objectives, the following research questions were raised for the study:

- I. What is the self-efficacy level of preservice biology teachers in creating models of plants and animal cells and human digestive system after using YouTube tutorials?
- II. What are the challenges that may hinder the use of YouTube tutorials in learning procedures and skill for improvising models of biological structures among preservice biology teachers?

Methodology

This study adopted descriptive survey research design. The population of the study comprises 285 preservice of the Department of science education, Sokoto State University. The sample size (196) was determined using a research advisor table (2006) for estimating sample size of given population. Samples were selected using proportionate sampling technique. The study used two instruments for data collection. Biological Model Development Self-Efficacy Questionnaire (BMDSQ) and open-ended Interview schedule. The BMDSQ was designed to assess the level of self-efficacy of the respondents on developing models of biological structures. It was divided into two sections. Section A sought for demographic information of the respondents while section B consisted of 8 items seeking the level of confidence and belief of the respondents to create a model. Each item was assessed based 4 four-point Likert Scale ranging from 4 (strongly confident) to 1 (not confident). The overall score of each participant determines his/her level of self-efficacy to create the model. The Interview schedule was on the other hand designed to collect the responses of the participants on the challenges of using YouTube tutorials in teaching and learning biological concepts and processes.

The instruments were validated by specialists in Biology education, measurement and evaluation and instructional technology. Their comments and observations were noted and used to improve instruments. The reliability index of the BMDSQ was obtained following a pilot study involving 15 preservice biology teachers. Their scores were organized to calculate its reliability index using Cronbach alpha with the help of SPSS statistical software and a coefficient 0.74 was obtained

Data collection lasted for three days and activities such as watching and downloading videos of YouTube tutorials demonstrating how to create some models of biological structure such as plant cell, animal cell and human digestive system

Data collection lasted for three days and several activities were carried out during this phase. The activities of the first day involve the display of samples of industrially made models of human skeleton, digestive system, excretory system, plant cell and animal cell. Participants were allowed to carefully observe each model. Afterward, they were asked to express their confidence in developing or improvising samples of the models displayed. The activities of the second day involve playing videos of YouTube tutorials demonstrating how to create some models of biological structure such as plant cell, animal cell and human digestive system. After a specific period of watching and learning from the videos, participants were requested to download such videos and watch them again at home. The third activity which occurs on the third day, involves the administration of the BMDSQ to assess the level of self-efficacy of each participant to create models of biological structures. The last activity was the interview of the five selected participants regarding the challenges of using You Tube tutorials in teaching and learning biological concepts and processes.

The scores of BMDSQ of all the participants were recorded, organized and analysed using descriptive statistics involving simple percentage, mean and standard deviation to answer research questions one. The data obtained from the interview was analysed using thematic analysis.

Results

Research Question 1: What is the self-efficacy level of preservice biology teachers in creating models of plants and animal cells and human digestive system after using YouTube tutorials? Table 1: Result of Preservice Biology Teachers Level of Self-Efficacy

Table 1: Result of Preservice Biology Teachers Level of Self-Efficacy							
S/N	Items	Response				Mean	Decision
		NC	LC	MC	HC		
Levels of Self-Efficacy							
1	I can accurately create models of plant cell, animal cell and human digestive system	36	25	83	52	2.8	Moderately Confident
2	I can create the models that clearly identify the key components of the Structure	42	61	73	20	2.4	Low Confident
3	I can create the models that is simple and easy to understand	20	31	80	65	3.0	Moderately Confident
4	The skills acquired can contribute positively in creating biological models.	10	12	39	135	3.5	Highly Confident
5	I can comfortably handle different basic tools in developing biological	17	43	91	45	2.8	Moderately Confident

	models.							
6	I can overcome the hurdles that may arise while developing models of biological structure	12	48	84	52	2.9	Moderately Confident	
7	I can positively respond to criticism and suggestions related to the model of biological structure I created .	43	35	62	56	2.7	Moderately Confident	
8	I can be focused and composed while creating models of biological structures	32	28	74	62	2.8	Moderately Confident	

Table 1 Key: NC = Not Confident; LC = Low Confident; MC = Moderately Confident; HC = Highly Confident

Table 1 presents the analyses of the Biological Model Development Self-Efficacy Questionnaire which sought to preservice biology teachers' level of self-efficacy to create physical biological models after learning the processes through youtube video tutorials. The Table shows that the mean score of the preservice teachers respond on item one is 2.8, indicating that the participants are moderately confident they can accurately create models of plant cell, animal cell and human digestive system. The Table also shows that the mean score preservice teachers respond on item two is 2.4, this revealed that their confidence level on creating the models of biological structure (plant cell, animal cell and human digestive system) which clearly identify the key components of the structure is low. Furthermore, the analyses on the Table shows that the mean score of participants on item three is 3.0 which means that they are moderately confident in creating the biological models that are simple and easy to understand. Also, the analyses of the participants' level of confidence on item four have the mean score of 3.5 which suggested that participants in the study are highly confident the skills acquired can contribute positively in creating models of biological structures such as plant cell, animal cell and human digestive system.

The analysis of the preservice biology teachers' responses on item five shown on Table 3 revealed that the mean score of the responses is 2.8 which means that the teachers are moderately confident in handling different basic tools in developing models of biological structures comfortably. Similarly, the showed that the mean score of responses on item six is 2.9, indicating that the respondents are moderately confident they can overcome the hurdles that may arise while developing models of biological structure. The Table also showed that the mean score preservice teachers respond on item seven is 2.7, this revealed that their confidence level on positively responding to criticism and suggestion related to the model of biological structure created was moderate.

Finally, the analyses on the Table showed that the mean score of responses on item eight is 2.8, indicating that the respondents are moderately confident of remaining focused and composed while creating models of biological structures. Based on these analyses, it is clear to say that the self-efficacy level of preservice biology teachers to create models of plants and animal cells and human digestive system after using YouTube tutorials was found to be moderate in most of the items used in the assessment. However, the result showed that the participants showed low confidence in creating a detailed model of biological structure. This therefore provides an answer to research question 1.

Research Question 2: What are the challenges that may hinder the use of YouTube tutorials in learning procedures and skill for improvising models of biological structures among preservice biology teachers?

Table 2: Themes, Codes and Sample Quotes of the Respondent

S/N	Theme	Codes	Sample Quotes from Students
	Accessibility of the YouTube Tutorials	Lack of gadgets (computers, mobile phones) Poor Internet access High cost of data subscription Limited phone capabilities (keypad vs Android)	“I think i cannot use YouTube because i don't have the gadgets like computer and mobile phones” (Participant 1) “I feel it is difficult to use YouTube due to poor internet access” (Participant 2) “I believe the main challenge of using YouTube is high cost of data subscription” (Participant 3) “The type of mobile phone i am using is keypad not android” (Participant 4)
	Language and Accent related challenges	Difficulty understanding non-Nigerian accents Struggling with non-English languages (Indian, Chinese) Audio speed affecting comprehension	“The ascents used in most of videos we used are not Nigerian or African base, that is why I struggle sometime and require help and interpretation” (Participant 1) “Most of the videos I watched were either produced by Asians, Americans or Europeans. Sometimes I have to watch the clips 3 times to understand some words.” (Participant 2) “Sometimes you may see a video that interests you, when open to watch it you discover that the language of communication is neither your native nor English. It usually Indian or Chinese” (Participant 3) “The speed of the audio of some videos affect my understanding because I learn with slow and steady speakers” (Participant 4)

Availability and affordability of Improvisation Materials	Materials not available locally	“Most of the materials used to demonstrate the improvisation of some biological models are not available in my locality” (Participant 1)
	Materials available but not free	“I think the materials used in the videos to demonstrate models of biological structures are available in my town but not free” (Participant 2)
	Substitutes available and free	“I believe the materials can be found in the town but not for cheap” (Participant 3)
		“I think those materials may not necessarily be available for free but there are substitutes available and free.” (Participant 4)
Videos Distractions	Students getting distracted by frequent advertisement and videos notifications	“I think sometime we are grouped to come closer and observed the videos while some of us are seating anxiously waiting for their turn and others discussing their task to report their observations, this makes our classroom noisy most of the time” (Participant 1)
	Noise and disruptions during group work	“the videos are short with many advertisements before and during tutorials” (Participant 2)
	Video length impacting classroom noise	“I get distracted by some other videos notifications” (Participant 3)

The data presented on Table 2 showed a thematic analysis of the responses obtained from the respondents through an open ended interview. It showed the themes, codes and extracts of some responses. The themes highlighted the perceived challenges of using YouTube tutorials, they include Access to the internet, Language barrier, non-availability and affordability of materials and classroom distraction.

The first theme or challenges was Access to the YouTube tutorials. It refers to the participants’ ability to access, watch and download YouTube videos which requires some ICT gadgets and services such as Computers, Smartphones and internet subscription. Some participants reported that lack of gadgets like

mobile phones or limited capabilities of the phones are the hindrances to accessing the YouTube tutorials. Two other participants believed poor internet and high cost data are the obstacles associated with the use of YouTube tutorials while learning the procedures and skills of making or improvising models of biological structures.

The second theme identified from the result of the interview was language barrier. It was defined by the participants as the inability to comprehend the language or accent used in the audios of some YouTube tutorials due to accent variation or language barrier. A participant reported most of the audios though are in English, they neither used Nigerian nor African accent, hence he sometimes seeks for help and interpretation from someone who is more exposed to English proficiency. Another participant revealed that sometimes he may see a video that interests him but when he begins to watch it he discovers the language of its audio is either Indian or Chinese which he doesn't understand.

The third theme is the non-availability and affordability of materials. It relates to the extent of the availability and affordability of materials used in the videos to demonstrate the improvisation of models of biological structures. One participant stated that most of the materials used in demonstrating the improvisation of models of biological models biological structures are not available in his surroundings. However, another participant reported that such materials are available in his surroundings but they are neither free nor low-cost

The fourth and last theme is Classroom distractions. These themes suggested that using YouTube tutorials to acquire skills for improvisation of models of biological structures make classrooms noisy and distractive. One participant reported that while watching the videos in the classroom, they sometimes get distracted by some of their colleagues who are discussing their classwork and preparing their report and also those anxiously waiting to be invited to watch the videos. Another participant believed that long videos make the classroom noisy

Discussion

The findings of this study provided insights on the influence of YouTube tutorials on the level of self-efficacy of preservice biology teacher ability to

develop models of biological structures. It also highlighted the possible challenges associated with learning procedural knowledge and skills for creating or improvisation of models of biological structures.

The first finding of this study was made from the data obtained from the BMDSEQ which was presented on Table 1. The analysis presented revealed that most preservice biology teachers are moderately confident of creating accurate and simple models of plant cell, animal cell and human digestive system, after watching YouTube videos demonstrating how to create the models. However, most of the respondents indicated low confidence in creating the detailed models mentioned earlier with clearly identified components. This implies that using YouTube tutorials to acquire procedural knowledge and skills does not guarantee that every learner will develop a high level of confidence in creating the exact product demonstrated and produced in video tutorials he/she watched. Furthermore, the finding implies that the knowledge and skills acquired from the YouTube tutorials may not be sufficient enough to make the learner feel highly and moderately confident to develop detailed models of biological structures by showing its basic components. Regardless of this mixed outcome, it is obvious that YouTube tutorials make the learners feel confident in developing the exact product they have watched in the video. This agrees with Teng (2015) whose study revealed that learning through YouTube tutorials strengthens the level of self-efficacy of the learner

The second finding was made from the data presented on Table 2, It revealed the challenges faced by preservice biology teachers while learning through YouTube tutorials. These challenges are poor internet connection and high cost of data, language barrier / Ascent variation, non-availability and affordability of improvisation materials and distractions associated with frequent advertisement and other video notifications during the lesson. This implies that no matter how much someone wants to use YouTube tutorials for learning, there are hindrances to overcome. The part of the finding which relates to poor internet access and high cost of data or subscription agree with Nurwahidah and Sitti (2023) which reported unstable internet connection among the challenges faced by University students and teachers while using YouTube videos. The study further quoted one participant saying that unstable internet connection was responsible for the poor quality of the audio of the videos causing a lot of break in and out. Thus making the learning through YouTube videos boring and difficult. The other challenge reported by the

participants which relates to distraction due to frequent advertisement and suggested videos notification was supported by Alshaikhi and Khasawneh (2025) which also revealed that YouTube advertisement, pop up notification and recommendations of other videos are among the challenges of learning through YouTube videos. These distractions usually affect the focus of the learner and makes learning difficult (Kalliebe & Shah, 2024)

Conclusion

Sequel to the findings revealed in this study, it can be concluded that YouTube tutorials improve the level of self-efficacy, but with some limitations of creating a detailed product. The study also concluded that learning through YouTube is associated with challenges such as poor internet connection and high cost of data, language barrier / Accent variation, non-availability and affordability of improvisation materials and distractions associated with frequent advertisement and other video notifications during the lesson. It is therefore, imperative

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Curriculum Outcomes, Psycho-Social Characteristics and Entrepreneurship Abilities of Polytechnics Graduates in Ondo and Osun State, Nigeria: Implication for National Re-Orientation and Development

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Abstract

This study examined the curriculum outcomes psycho-social characteristics and entrepreneurship abilities of polytechnics graduates in ondo and osun state, nigeria : implication for national re-orientation and development. This study adopted an ex-post facto design to predict curriculum outcomes and psycho social-characteristics on the entrepreneurial abilities of polytechnics graduates. The ex-post facto research design was adopted in this study. The research design was employed because the researcher is to identify the relationship and cause-effects of independent variables in the study. Also, it was not an experimental study. All Management and Social Science HND graduates of 2025/2026 session consisted the population of the study. Two hundred and forty five (245) HND graduates purposively selected participated in the study. Three research questions were raised and answered in the study. The curriculum outcomes questionnaire, and personality characteristics questionnaire and entrepreneurial ability inventory were validated and used for data collection. The multiple regression analysis and Pearson moment correlation were the major statistical tools used for data analysis. The findings revealed that the computed t-value of 8.42 with 224 degrees of freedom yields a two-tailed significance value of .000, which is less than the alpha level of 0.05. Consequently, the null hypothesis is rejected. The mean score for psycho-social characteristics (3.67) and entrepreneurship abilities (3.52) both fall above the midpoint of 2.5, indicating moderate-to-high levels among graduates. Again, with a t-value of 5.67 and a significance level of .000 ($p < 0.05$), the null hypothesis is rejected. This indicates that the formal curriculum delivered in polytechnics significantly influences graduates' ability to engage in entrepreneurial activities. Findings from the study revealed that the predictors variables (curriculum outcomes, psycho social characteristics) when combined jointly accounted for both predictors are statistically significant at $p < .001$. Psycho-social characteristics ($\beta = 0.486$) have a stronger standardized contribution than curriculum outcomes ($\beta = 0.398$). The findings further revealed that positive and significant relationships exist among curriculum outcomes psycho-social characteristics and entrepreneurial abilities of HND. graduates. It is recommended among others, that they should strengthen curriculum outcomes by integrating experiential learning, business incubation programs, and mandatory entrepreneurship projects.

Keywords: Curriculum outcomes, psycho-social characteristics, entrepreneurial abilities and polytechnics graduates

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Introduction

Entrepreneurship is the willingness and ability of an individual to seek for investment opportunities, to establish and to run an enterprise successfully. With the soaring unemployment rate in Nigeria, self employment and small enterprise initiatives are presently high on the country's national agenda, in the hope that they will provide alternative channels of employment. Yearly, thousands of graduates join the labour market in search of gainful employment. The challenge is thus one of not only tackling the already sizeable unemployed graduates, but also of absorbing the new entrants into the labour market. Underlying this situation is the fact that the training which tertiary students receive has not been fully successful in equipping them with desirable skills and competencies required for job creation and self employment (Adelokun *et al.* 2017).). There best way to tackle poverty and reduce unemployment is to introduce youths to the intricacies of entrepreneurship (Ademiluyi *et al.*, 2020; Akinola, 2017). The realization of this critical fact underlies the directive of the Federal Government to all tertiary education regulatory agencies to establish necessary mechanisms for the introduction, development and sustenance of entrepreneurial culture among Nigerian youth.

Consequently, many tertiary institutions have initiated entrepreneurship education programmes in an attempt to reverse graduate unemployment trend by giving the needed training in entrepreneurial skills to students for setting up businesses and to consider selfemployment as a viable career option. Entrepreneurship implies the creation of job by the younger generation EEE – employment, economic activity and self-engagement (Blasé *et al.*,2025). In Olorundare and Kayode (2014) reports that entrepreneurship as a practical creativeness which combines resources and opportunities in new ways. It involves the application of personal qualities and others resources with the environment for the attainment of business success. Entrepreneurship education does not only provides an opportunity for work but also such a platform later on to develop new products, new services and new technologies which support the society in one way or another (Taks *et al.*, 2014; Wang, 2022). is an imperative that would make a positive contribution to improving the entrepreneurship orientation of people, leading to the acquisition of skills, creativity, confidence, drive, and courage, in order to create employment for self and others.

Entrepreneurship education has come to denote all forms of knowledge delivery that seek to empower the individual to create wealth in the economic sector, thereby advancing the course of development of the nation as a whole. According to Oni and Olaleye, 2004, the goal of entrepreneurship education is to empower the graduates, irrespective of their areas of specialization, with skills that will enable them to engage in income yielding ventures, if they are unable to secure jobs in the public sector. It is a re-orientation from job seekers to job creators. Entrepreneurship is concerned with creating opportunities, meeting the needs of individuals and is a process of identifying gaps in one immediate environment, community and society at large and bringing together resources in an innovative and profitable way to fill these gaps (Oni & Olaleye, 2004; Ogundele, 2020, Umoru & Orah, 2020).

The objectives of entrepreneurship education as succinctly presented by the European Akinola, (2017) include: "raising students awareness of self employment as a career option (the message being that you can become not only an employee, but also an employer); promoting the development of personal qualities that are relevant to entrepreneurship, such as creativity, risk taking and responsibility; and providing the technical and business skills that are needed in order to start a new venture". From the foregoing it can be deduced that exposure of polytechnics graduates to entrepreneurial education will ginger-up entrepreneurial drive and if properly packaged, can be a significant factor in chronic unemployment reduction among graduates.

In empirical work by Tetteh et al (2024), they conducted this so as to do a literature review that focused on the impact of entrepreneurship intentions in light of macro-environmental factors and society values vis-à-vis infrastructure development, government policies and access to finance. Tran, and Von korflesh, (2016) confirmed that students who graduated in entrepreneurship reached higher scores in entrepreneurial intention, ability, self efficacy and aspiration than students who graduated in other disciplines. This will help graduates to acquire entrepreneurial approach to the world of work and prepare them to act as entrepreneurs and managers of a new business.

Similarly, Varela and Jimenez (2001) study has shown that there is a correlation between a polytechnics investment in the promotion of entrepreneurship and the percentage of students becoming entrepreneurs. Additional research by Das (2025) found that entrepreneurship education

create a positive image for the entrepreneurs and contributes to the choice of entrepreneurship as a professional alternatives by graduates.

Lally and Valantime-French (2018), in related studies found that entrepreneurship teachers should promote in their students psychological and personality characteristics which may enhance their entrepreneurship prospects qualities like optimism, courage, fortitude that will developed in entrepreneurship training and also increase students' abilities and interest in entrepreneurship as a career. In the same vein, Tkachev and Kolvereid (1999) findings showed that self employment and entrepreneurial abilities could be increased through Entrepreneurship Training Programme (ETP). Bassey and Olu (2012) investigated how students' perception of tertiary entrepreneurship education relates to graduate self employment potentials in Nigeria using a sample of 690 students in three universities. The findings showed that there was a significant relationship between students' perception of University·administration's provision for tertiary entrepreneurship education, curriculum objectives for tertiary entrepreneurship education, instructional methods for tertiary entrepreneurship education, quality and quantity of tertiary entrepreneurship education instructor's and students entrepreneurial abilities ,tracts and graduate self employment potential. Currently, Polytechnics and Federal Colleges in Nigeria are the key implementers of this skills or ideas. They run entrepreneurship courses and offer expertise programmes as well as access to resources which grow a students into an entrepreneur (Oiku, & Akanbi, 2023). National Board of Technical Education has incorporated entrepreneurship education programmes into their curriculum in line with the contributions of curriculum outcomes and psycho-social characteristics on entrepreneurial abilities of polytechnics students.

Research Questions

The following questions were raised to guide the study;

- I. Is there a significant relationship between curriculum outcomes HND graduates entrepreneurial abilities?
- II. Is there a significant relationship between psycho-social characteristics and HND graduates entrepreneurial abilities?

- III. What is the combined contribution of curriculum outcomes and psycho-social characteristics on HND graduates' entrepreneurial abilities?

Methodology

The study was conducted in Ondo and Osun State in South-western, Nigeria. The ex-post facto research design was adopted in this study. The research design was employed because the researcher is to identify the relationship and cause-effects of independent variables in the study. Also, it was not an experimental study. All Management and Social Science HND graduates of 2025/2026 session consisted the population of the study. The sample population consisted of 225 HND graduates from three (3) Polytechnics in Ondo and Osun State, which includes Federal Polytechnic Ede, (80), Osun State Polytechnic, Iree (75), and Rufus Giwa Polytechnic, Owo, Ondo State (70). Three research instruments were used for data collection and were developed by the researcher. They were curriculum outcomes questionnaire (COQ), personality characteristic questionnaire (PCQ) and entrepreneurial ability inventory (EAI). The research instrument was a structured questionnaire based on the formulated research questions and hypothesis. Each of the three questionnaires consists of two sections. The section A of each of the trio obtained demographic information of the respondents such as, name of school, sex, age, year of graduation. The five point likert type scale was used in section B of each of the three questionnaires. Mean scores are based on a 5-point Likert scale (1 = Very Low, 5 = Very High). The respondents were asked to tick the column that matches their feelings from the options. The section B of COQ contained 20 items which sought information on curriculum outcomes. The PCQ also contained 15 items which sought information on psycho-social characteristics. The EAI contained 20 items, which sought information on entrepreneurial abilities. The instruments were validated by experts in Entrepreneurship Education and Counseling Psychology Department from Adeyemi Federal University of Education, Ondo. The experts scrutinized the item on the instrument to ensure conformity with various contents of curriculum. The comments, observations and suggestions were harmonized and taken into account in preparing the final version of the instruments. The reliability of the instruments was conducted at Federal Polytechnic, Ado-Ekiti, Ekiti State which was outside the sample population of the study. Cronbach alpha reliability co-efficient of 0.78, 0.71 and 0.75 were obtained for COQ, PCQ and EAI respectively. Data collected were

analyzed using t – test and simple linear regression for hypothesis. The null hypothesis was tested at 0.05 level of significance using samples t – test. Where the calculated p value was less than or equal to 0.05 level of significance, the null hypothesis was to rejected. Also, if the calculated p value was greater than the level of significance, the null hypothesis was to be accepted.

Results

Analysis of Research Questions:

Research Question 1: Is there a significant relationship between psycho-social characteristics and graduates' entrepreneurship abilities?

Table 1: t-Test Results for Psycho-Social Characteristics vs. Entrepreneurship Abilities

Variable	Mean	Std. Deviation	t-value	df	Sig. (2-tailed)	Decision
Psycho-Social Characteristics	3.67	0.78	8.42	224	.000	Reject H_0
Entrepreneurship Abilities	3.52	0.81				

The table 1, t-test analysis reveals a statistically significant relationship between psycho-social characteristics and entrepreneurship abilities among polytechnic graduates in Ondo and Osun States. The computed t-value of 8.42 with 224 degrees of freedom yields a two-tailed significance value of .000, which is less than the alpha level of 0.05. Consequently, the null hypothesis is rejected. The mean score for psycho-social characteristics (3.67) and entrepreneurship abilities (3.52) both fall above the midpoint of 2.5, indicating moderate-to-high levels among graduates. The t-value being positive and significant suggests that graduates with stronger psycho-social characteristics, such as self-efficacy, motivation, resilience, social networks, and risk-taking propensity tend to demonstrate higher entrepreneurship abilities.

Research Question 2: Is there a significant relationship between curriculum outcomes and graduates' entrepreneurship abilities?

Table 2: t-Test Results for Curriculum Outcomes vs. Entrepreneurship Abilities

Variable	Mean	Std. Deviation	t-value	df	Sig. (2-tailed)	Decision
Curriculum Outcomes	3.15	0.85	5.67	224	.000	Reject H_0
Entrepreneurship	3.52	0.81				

Abilities

The table 2 t-test results demonstrate a statistically significant relationship between curriculum outcomes and entrepreneurship abilities. With a t-value of

5.67 and a significance level of .000 ($p < 0.05$), the null hypothesis is rejected. This indicates that the formal curriculum delivered in polytechnics significantly influences graduates' ability to engage in entrepreneurial activities. The mean score for curriculum outcomes (3.15) is lower than that for psycho-social characteristics (3.67), suggesting that graduates perceive the formal curriculum as moderately effective but with room for improvement.

Research Question 3: What is the combined contribution of curriculum outcomes and psycho-social characteristics on HND graduates' entrepreneurship abilities?

Table 3.1: Model Summary (Research Question 3)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.742	0.551	0.547	0.534

R Square = 0.551 indicates that 55.1% of the variance in graduates' entrepreneurship abilities is explained by the combined contribution of curriculum outcomes and psycho-social characteristics.

Table 3.2: ANOVA (Research Question 3)

Source of Variation	Sum of Squares (SS)	Df	Mean Square (MS)	F-Ratio	Sig. (p)
Regression	78.45	2	39.23	137.80	.000
Residual (Error)	63.20	222	0.285		
Total	141.65	224			

Note : $F(2,222) = 137.80, p < .001$. The regression model is statistically significant.

Table 3.3: Coefficients (Research Question 3)

Model	Unstandardized Coefficients	Standardized Coefficients	T	Sig. (p)
	B	Std. Error	Beta	
(Constant)	0.845	0.152	5.56	.000
Curriculum Outcomes	0.412	0.058	0.398	7.10 .000
Psycho-Social Characteristics	0.538	0.062	0.486	8.68 .000

Both predictors are statistically significant at $p < .001$. Psycho-social characteristics ($\beta = 0.486$) have a stronger standardized contribution than curriculum outcomes ($\beta = 0.398$).

Discussion

In this study three research questions were formulated and tested in this study. Findings from research hypothesis one revealed the significant relationship between psycho-social characteristics and entrepreneurship abilities ($t = 8.42$, $p < .001$) underscores the importance of psychological and social capital. Graduates who possess self-confidence, resilience, motivation, and strong social networks are better equipped to identify opportunities, take calculated risks, and persist through entrepreneurial challenges. This finding challenges the narrow view that entrepreneurship is solely about technical skills or business knowledge. National re-orientation programs must therefore address psycho-social development alongside formal education. The finding support Kiseltsa *et al.* (2018) that psychological factors such as self concept, self efficacy and mentoring significantly determine students' entrepreneurial abilities and risk taking behaviour. In addition the knowledge of entrepreneurship possessed by students is critical factors underlying their entrepreneurial capacity and intention. The findings from research hypothesis two also revealed the significant relationship between curriculum outcomes and entrepreneurship abilities ($t = 5.67$, $p < .001$) confirms that polytechnic curricula do matter. However, the lower mean score for curriculum outcomes (3.15) compared to psycho-social characteristics (3.67) suggests that graduates perceive their formal training as only moderately effective. Many polytechnic programs may still emphasize theoretical content over practical, experiential learning. Curriculum reform should prioritize hands-on projects, industry attachments, and real-world business simulations. The result confirms the finding of Folaranmi *et al.* (2010) that entrepreneurial training practical should be expanded in duration than the theory contents. The findings of the combined regression model ($R^2 = 0.551$, $F = 137.80$, $p < .001$) demonstrates that curriculum outcomes and psycho-social characteristics together explain over half of the variance in entrepreneurship abilities. The fact that psycho-social characteristics ($\beta = 0.486$) contribute slightly more than curriculum outcomes ($\beta = 0.398$) suggests that while formal education is important, the graduate's internal drive and social environment are even more critical. This

has profound implications: even the best curriculum will fail to produce entrepreneurial graduates if their psycho-social characteristics are weak. Conversely, graduates with strong psycho-social characteristics may succeed despite moderate curriculum quality, though optimal outcomes require both. This findings is align with Owusu – Ansha (2004), Iwu and Nzeako (2012) that psychological factors such as self concept, self efficacy and mentoring significantly determine students' entrepreneurial abilities and risk taking behaviour. The significant constant in the regression model ($B = 0.845$, $p < .001$) indicates that other unmeasured factors also contribute to entrepreneurship abilities. These may include innate personality traits (e.g., openness to experience, conscientiousness), access to financial resources, family entrepreneurial background, and regional economic opportunities. Future research should incorporate these variables to increase explanatory power.

Conclusion

The following conclusions are drawn from the findings as following:

- I. There is a significant relationship between psycho-social characteristics and graduates' entrepreneurship abilities. The null hypothesis is rejected. Graduates with stronger self-efficacy, motivation, resilience, and social support networks demonstrate higher entrepreneurship abilities.
- II. There is a significant relationship between curriculum outcomes and graduates' entrepreneurship abilities. The null hypothesis is rejected. The formal polytechnic curriculum significantly influences graduates' ability to engage in entrepreneurial activities, though perceived effectiveness is only moderate.
- III. Curriculum outcomes and psycho-social characteristics together make a significant combined contribution to HND graduates' entrepreneurship abilities. The null hypothesis is rejected. The combined model explains 55.1% of the variance in entrepreneurship abilities, with psycho-social characteristics ($\beta = 0.486$) contributing slightly more than curriculum outcomes ($\beta = 0.398$).

- IV. Psycho-social characteristics are marginally more influential than curriculum outcomes in predicting entrepreneurship abilities among polytechnic graduates in the study area.
- V. Approximately 44.9% of the variance in entrepreneurship abilities remains unexplained, suggesting that other factors such as access to capital, family background, government policies, and regional economic conditions also play important roles.

Recommendations

For Polytechnic Administrators and Curriculum Planners

- I. Strengthen curriculum outcomes by integrating experiential learning, business incubation programs, and mandatory entrepreneurship projects. Move beyond theoretical teaching to practical, market-relevant training.
- II. Review and update curriculum content regularly to reflect current industry trends, technological advancements, and local market opportunities.
- III. Increase the mean score for curriculum outcomes from the current 3.15 to at least 4.0 by ensuring that entrepreneurship courses are practical, assessed through business plan development, and linked to real-world mentorship.

For Psycho-Social Development

- I. Establish psycho-social support programs within polytechnics, including mentorship schemes, motivational seminars, resilience training, and peer support groups to strengthen students' psychological capital.
- II. Incorporate psycho-social assessments during student admission and throughout the program to identify at-risk students who may need additional support in developing entrepreneurial self-efficacy and motivation.

- III. Engage successful entrepreneurs as role models to inspire students and demonstrate that entrepreneurial success is attainable, thereby enhancing students' outcome expectations.

For National Re-orientation and Development Policy

- I. Launch national re-orientation campaigns that celebrate entrepreneurship as a respectable and viable career path, shifting cultural attitudes away from over-reliance on white-collar government jobs.
- II. Integrate psycho-social entrepreneurship education into secondary and tertiary curricula nationwide, recognizing that entrepreneurial abilities are shaped as much by mindset as by skills.
- III. Create a national entrepreneurship development framework that explicitly combines curriculum reform (formal education) with psycho-social interventions (mentorship, motivation, social capital building).

For Government and Policymakers

- I. Provide funding and incentives for polytechnics to develop entrepreneurship centers, business incubators, and linkages with financial institutions for startup capital access.
- II. Establish graduate entrepreneurship tracking systems to monitor the relationship between curriculum, psycho-social characteristics, and actual business formation, using data to refine policies.
- III. Address the unexplained variance by investing in complementary factors such as access to microcredit, entrepreneurial infrastructure, and market linkages for new graduates.

Implications for National Re-orientation and Development

The findings of this study carry profound implications for Nigeria's national re-orientation and development agenda:

- I. Human capital development must address both cognitive (curriculum) and non-cognitive (psycho-social) domains. Current educational policies overemphasize the former while neglecting the latter.
- II. National re-orientation programs such as the National Orientation Agency (NOA) campaigns should explicitly target psycho-social characteristics—building self-efficacy, fostering achievement motivation, and promoting positive attitudes toward risk-taking and innovation.
- III. Sustainable development in Nigeria requires a critical mass of entrepreneurial graduates who can create jobs, drive innovation, and reduce dependence on oil revenues and government employment. This study demonstrates that achieving this goal requires simultaneous investment in curriculum reform and psycho-social development.
- IV. The polytechnic system, as a producer of middle-level technical manpower, should be positioned as a key driver of economic diversification. However, this study shows that current curriculum outcomes are only moderately effective. Urgent reform is needed.

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Effects of Bibliotherapy Counselling in Curbing Anxiety and Depression among Students in Women Centers for Continuing Education in Sokoto Metropolis

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Abstract

This study investigated on the effectiveness of bibliotherapy counselling in reducing depression and anxiety among married women attending Women's Centres for Continuing Education in Sokoto State. The study adopted quasi-experimental survey of pre-test and post-test control design. Eighty (80) married women were sampled for meeting inclusion criteria via multi-stage sampling and assigned to an experimental bibliotherapy group (n = 40) and a control group (n = 40). Two Objectives and two hypotheses were formulated that guided the study. Two adopted questionnaires named Beck Depression Inventory (ADI) and the Beck Anxiety Inventory (BAI) were used for data collection. Data were analyzed using one-way analysis of covariance (ANCOVA) to control for pretest scores. All statistical analyses were performed using IBM SPSS Statistics Version 26. The results showed dramatic reductions for the bibliotherapy experimental group. It was recommended that bibliotherapy counselling intervention should be integrated among the counselling services render in the center.

Keywords: Bibliotherapy Counselling; Depression; Anxiety; Women's Centres; Adult Education; Mental Health Intervention; Sokoto

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Introduction

Mental health challenges such as depression and anxiety have become increasingly prevalent among women enrolled in Women's Centres for Continuing Education, particularly in culturally oriented settings like Sokoto State. Many of these women face multiple stressors including domestic responsibilities, financial pressures, marital expectations, child-rearing obligations, and the demands of academic activities. These stressors expose them to psychological distress that often manifests as persistent sadness, fatigue, excessive worry, concentration difficulties, irritability, and emotional withdrawal (American Psychological Association, 2023). Such mental-health challenges negatively affect their academic performance, interpersonal relationships, attendance, and overall well-being.

Globally, depression and anxiety are leading causes of disability, affecting more than 300 million and 280 million people respectively (World Health Organization, 2023). Women are disproportionately affected due to socio-cultural pressures, hormonal influences, role conflicts, and limited access to mental-health services (Albert, 2021). In Nigeria, research shows that women in adult-education settings often experience untreated psychological distress due to stigma, lack of awareness, and inadequate mental-health infrastructure (Abdulmalik et al., 2022).

Bibliotherapy counselling has emerged as a promising psychological intervention for addressing mental-health challenges, especially where professional services are limited. Bibliotherapy involves the systematic use of reading materials, such as self-help texts, short stories, inspirational literature, and guided narratives: to help individuals understand their emotions, reframe negative thoughts, and develop healthy coping strategies (Pardeck & Pardeck, 2021). It draws from principles of cognitive-behavioural therapy (CBT), enabling readers to challenge maladaptive thinking patterns and replaces them with more balanced thoughts (Beck, 2020). Studies indicate that bibliotherapy is cost-effective, accessible, and culturally adaptable, making it particularly suitable for community-based educational settings (Forrest & McHugh, 2020; Cuijpers et al., 2021).

Depression and anxiety have become increasingly common psychological challenges among women enrolled in Women's Centres for Continuing Education in Sokoto State. Many of these women experience a combination of

domestic responsibilities, marital expectations, financial constraints, academic pressure, and child-care obligations. These multiple stressors often lead to emotional difficulties such as persistent sadness, hopelessness, excessive worry, irritability, loss of interest, fatigue, and concentration problems, all of which are indicators of depression and anxiety as identified by the American Psychological Association (2023). When left unaddressed, depression and anxiety negatively affect women's academic performance, attendance, interpersonal relationships, and general well-being, making mental-health intervention a critical need in these centres.

One promising intervention for addressing these psychological difficulties is **bibliotherapy**, a counselling technique that uses guided reading materials to help individuals understand their emotions, challenge negative thoughts, and develop healthier coping strategies. Bibliotherapy draws from the principles of Cognitive Behavioural Theory (CBT), which explains that emotional distress, such as depression and anxiety, results from maladaptive thinking patterns. Through structured reading, reflective exercises, and relatable narratives, bibliotherapy enables women to identify unhelpful thoughts, gain insight into their emotional struggles, and replace negative cognitions with more balanced ones. Given the limited availability of mental-health services in Sokoto State, bibliotherapy provides a culturally appropriate, accessible, and cost-effective intervention for reducing depression and anxiety among women in Women's Centres.

Recent empirical evidence demonstrates that bibliotherapy can significantly reduce symptoms of depression and anxiety among women and adult learners. For instance, Jones and Brown (2022) found that the use of structured reading programs improved emotional resilience and reduced psychological distress in female adult students. Similarly, Sharma and Gupta (2021) reported that bibliotherapy empowered women in continuing education centres in India by providing relatable narratives that enhanced emotional processing and coping.

In Sokoto State, where mental-health resources remain limited, bibliotherapy counselling provides an opportunity to support women in Women's Centres in a manner that is affordable, non-intrusive, and culturally sensitive. Despite its potential benefits, limited empirical evidence exists regarding the effectiveness of this intervention for women in these centres. This gap necessitates a systematic investigation into how bibliotherapy counselling can reduce depression and anxiety among the target population.

This study is anchored on Cognitive Behavioural Theory (CBT) by Aaron T. Beck (1976), which explains that individuals experience depression and anxiety when they hold negative and distorted patterns of thinking. According to CBT, emotions and behaviours are influenced by how people interpret events, and modifying these maladaptive thoughts leads to improved mental well-being. Bibliotherapy is grounded in this principle, as guided reading materials help individuals challenge irrational thoughts, replace them with healthier interpretations, and learn coping strategies. In this study, the use of CBT-based bibliotherapy materials enabled women to reflect on their thoughts related to stress, marital expectations, academic pressure, and self-worth, which contributed to the significant reduction in depression and anxiety scores after the intervention.

The study is also supported by Bibliotherapy Theory proposed by Pardeck & Pardeck (1998), which emphasizes the therapeutic use of literature to promote emotional healing. The theory states that individuals identify with characters or messages in reading materials, experience emotional release (catharsis), and gain insight into their own challenges through guided reflection. These processes help readers understand their emotions, develop coping skills, and change maladaptive behaviours. In this study, culturally relevant reading materials allowed participants to relate to the narratives, process their emotions, and acquire healthier ways of dealing with stress. The dramatic improvements observed in the experimental group align with the theoretical assumption that literature can facilitate psychological change when appropriately guided. Therefore, this study examines the effectiveness of bibliotherapy counselling in reducing depression and anxiety among women in Women's Centres in Sokoto State, thereby contributing to improved mental well-being, academic productivity, and empowerment among adult female learners.

Empirical studies conducted globally and within Nigeria have demonstrated the effectiveness of bibliotherapy counselling as an intervention for reducing depression and anxiety among women, adult learners, and other vulnerable populations. This section presents a review of relevant empirical findings aligned with the study's objectives. Cuijpers et al. (2021) conducted a meta-analysis of 48 randomized controlled trials and found that bibliotherapy produced moderate to large reductions in depressive symptoms compared with control groups. The study concluded that structured, CBT-based reading

materials were particularly effective for adults with mild to moderate depression.

Forrest and McHugh (2020) examined the impact of bibliotherapy on women experiencing emotional distress. Their findings showed that participants exposed to guided reading sessions recorded significant improvements in mood, motivation, and overall emotional functioning.

Sharma and Gupta (2021) conducted an intervention study among women in continuing education centres in India. Results revealed that bibliotherapy significantly reduced depressive feelings associated with family pressure, low self-esteem, and academic stress.

Abdulmalik, Olayiwola, and Kola (2022) found that structured, culturally relevant reading programmes significantly reduced depression levels among women attending community literacy centres in Northern Nigeria. The study emphasized that bibliotherapy was well-suited to settings where counselling resources were limited.

Jones and Brown (2022) investigated the effect of reading-based interventions on anxiety among adult students. Their study found that bibliotherapy enhanced emotional resilience and reduced worry, fear, and tension among participants.

Taylor, Clark, and Evans (2023) reported that bibliotherapy significantly improved coping skills and reduced academic-related anxiety among adult women pursuing literacy and vocational training programmes. Van der Merwe and Pretorius (2022) implemented group bibliotherapy sessions among women in South African community centres. Results indicated substantial reductions in social anxiety and improved emotional bonding among the participants. Smith, Anderson, and Taylor (2023) found that structured self-help bibliotherapy reduced generalized anxiety symptoms by improving cognitive control and reducing avoidance behaviour.

In Nigeria, Okeke, Eze, and Onyebueke (2022) studied the effect of bibliotherapy on anxiety among women in adult education programmes in the South-East. Their findings showed a statistically significant reduction in anxiety levels after six weeks of guided reading and group reflection.

Further, Sokoto State Ministry of Health (2023) reported that bibliotherapy-based psychoeducational sessions improved emotional well-being and reduced anxiety among women participating in community learning centres across Sokoto metropolis.

Statement of the Problem

Women attending Women's Centres for Continuing Education in Sokoto State face multiple pressures such as academic demands, domestic responsibilities, marital expectations, and financial challenges. These pressures expose many of them to mental-health problems, especially depression and anxiety. Evidence from local reports and school counsellors indicates increasing cases of emotional distress, withdrawal from classes, poor academic performance, low self-esteem, and irregular attendance among women in these centres. Despite these challenges, mental-health support services remain extremely limited, and many women continue to suffer in silence due to cultural stigma and lack of access to professional counselling.

Traditional counselling methods available in the centres are often inadequate because of limited time, insufficient personnel, and lack of specialized mental-health resources. As a result, many women do not receive timely or effective psychological support. Bibliotherapy counselling, an intervention that uses guided reading and reflective learning, has been identified in research as a cost-effective and culturally acceptable method for addressing depression and anxiety. However, there is little or no documented evidence showing how effective this approach is among women in Women's Centres in Sokoto State.

Objectives of the Study

The study was guided by the following specific objectives:

- I. To assess the effect of bibliotherapy counselling in reducing depression among women in Women Centres in Sokoto State.
- II. To examine the effect of bibliotherapy counselling in reducing anxiety among women in Women Centres in Sokoto State.

Research Hypotheses

To guide the conduct of this research, the following null hypotheses were formulated:

- H0₁: There is no significant difference in using Bibliotherapy and counselling as an intervention for reducing depression among women in women centres in Sokoto state.
- H0₂: There is no significant difference *in using* Bibliotherapy and counselling in reducing anxiety among women in women centres in Sokoto state.

Methodology

This study adopted a quasi-experimental pretest–posttest control group design to examine the effectiveness of bibliotherapy counselling in reducing depression and anxiety among married women attending Women’s Centres in Sokoto Metropolis. The design was appropriate for investigating cause-and-effect relationships in a natural school setting where random assignment was not feasible. A total population of 520 married women enrolled across Women Centre I, II, and III formed the sampling frame. Using a multi-stage sampling technique, 80 married women who met the inclusion criteria (presence of depression/anxiety symptoms and willingness to participate) were selected. These participants were assigned into an experimental group (40) that received the bibliotherapy intervention and a control group (40) that received no treatment during the study. This arrangement ensured that meaningful comparisons could be made to test the study’s two hypotheses.

Data were collected using two standardized psychological instruments: the Adopted Beck Depression Inventory (ADI) and the Adopted Beck Anxiety Inventory (BAI), each containing 21 items rated on a four-point Likert scale. Both tools were validated by experts in Guidance and Counselling at Sokoto State University to ensure cultural relevance, and reliability was established through a pilot study that produced acceptable Cronbach’s alpha coefficients ($\alpha = 0.82$ for ADI and $\alpha = 0.79$ for BAI). Data collection occurred in two phases. In the pretest phase, both groups completed the ADI and BAI to determine baseline levels of depression and anxiety. This was followed by an eight-week bibliotherapy counselling intervention delivered to the experimental group using a structured, culturally adapted CBT-based

workbook (“Rayuwa Mai Kyau”) in guided reading sessions conducted twice weekly. The control group continued with normal academic activities without treatment. In the posttest phase, the same instruments were re-administered to both groups to determine changes in psychological states resulting from the intervention.

Data were analyzed using both descriptive and inferential statistics. Means and standard deviations were used to compare pretest and posttest scores of both groups. To test the study’s hypotheses, whether bibliotherapy counselling significantly reduced depression and anxiety Data were analyzed using one-way analysis of covariance (ANCOVA) to control for pretest scores. All statistical analyses were performed using IBM SPSS Statistics Version 26. an independent samples t-test was employed at the 0.05 significance level. This statistical method was appropriate for comparing two non-randomized intact groups in a quasi-experimental study. The results generated from these analyses provided the basis for determining the effectiveness of bibliotherapy counselling in achieving the study’s two objectives: (1) reducing depression and (2) reducing anxiety among married women in Women’s Centres in Sokoto Metropolis.

Results

A total of 80 participants (40 in the bibliotherapy group, 40 in the control group) were included in the analysis. Data were analyzed using one-way analysis of covariance (ANCOVA) to control for pretest scores. All statistical analyses were performed using IBM SPSS Statistics Version 26.

Table 1: Descriptive Statistics for ADI and BAI Scores by Group

Group	N	ADI Pretest M (SD)	ADI Posttest M (SD)	BAI Pretest M (SD)	BAI Posttest M (SD)
Control	40	27.20 (2.71)	26.20 (2.71)	21.20 (2.71)	20.95 (2.09)
Bibliotherapy	40	28.80 (2.69)	11.80 (2.04)	22.80 (2.69)	7.95 (1.85)
Total	80	28.00 (2.80)	19.00 (7.63)	22.00 (2.80)	14.45 (6.83)

Note: ADI = Anxiety and Depression Inventory; BAI = Beck Anxiety Inventory. Higher scores indicate greater symptom severity.

The bibliotherapy group had slightly higher mean scores than the control group on both the ADI (28.80 vs. 27.20) and BAI (22.80 vs. 21.20), indicating marginally greater symptom severity at baseline, though the groups remained reasonably comparable with nearly identical standard deviations of approximately 2.70. At post-test, the control group showed minimal change,

with ADI scores decreasing by just 1.00 point (from 27.20 to 26.20) and BAI scores by only 0.25 point (from 21.20 to 20.95), reflecting symptom stability in the absence of intervention. In contrast, the bibliotherapy group experienced substantial reductions, with ADI scores dropping 17.00 points (from 28.80 to 11.80) and BAI scores falling 14.85 points (from 22.80 to 7.95), bringing both measures into ranges typically associated with minimal or near-remission symptom levels. Posttest comparisons highlight a stark divergence, with the bibliotherapy group scoring 14.40 points lower on the ADI and 13.00 points lower on the BAI than the control group, and demonstrating slightly lower variability (SDs of 2.04 and 1.85), suggesting more consistent improvement across participants. The total sample means and large post-test standard deviations (7.63 for ADI; 6.83 for BAI) reflect the clear separation between the two groups one showing dramatic improvement, the other remaining largely unchanged.

These findings provide strong preliminary evidence that bibliotherapy counseling produced clinically meaningful reductions in both depression and anxiety among women in women centers in Sokoto State.

Hypothesis H₀₁

H₀₁: There is no significant difference between bibliotherapy and control in reducing depression among women in women centres in Sokoto state

Table 2: ANCOVA Results: Effect of Bibliotherapy on Post-test Depression (ADI)

Source	SS	df	MS	F	P	η^2p
ADI Pretest	379.82	1	379.82	423.95	<.001	.846
Group	4526.99	1	4526.99	5052.99	<.001	.985
Error	68.99	77	0.90			

Note: $R^2 = .985$ (Adjusted $R^2 = .985$).

Estimated Marginal Means (Adjusted for ADI Pretest = 28.00):

- I. Control: $M = 26.85$
- II. Bibliotherapy: $M = 11.15$
- III. Mean Difference = 15.71, $p < .001$ (Bonferroni-adjusted)

This demonstrates a highly significant effect of bibliotherapy on post-test depression scores after controlling for pre-test ADI levels. The covariate (ADI Pre-test) was statistically significant, $F(1, 77) = 423.95$, $p < .001$, $\eta^2p = .846$, indicating that baseline depression strongly predicted post-test outcomes and accounted for 84.6% of the variance. The main effect of Group was extremely large and significant, $F(1, 77) = 5052.99$, $p < .001$, $\eta^2p = .985$, meaning that 98.5% of the variance in post-test depression scores was explained by group membership (bibliotherapy vs. control) after adjusting for pre-test differences. The model explained nearly all variability in the outcome ($R^2 = .985$), leaving minimal unexplained error. Adjusted marginal means, evaluated at the overall pretest mean of 28.00, revealed that the bibliotherapy group had a posttest depression score of 11.15, compared to 26.85 in the control group a clinically and statistically significant difference of 15.71 points, $p < .001$. This confirms that bibliotherapy produced a profound reduction in depression symptoms among women in women centers in Sokoto State, and supports the rejection of H_{01} and H_{03} with overwhelming evidence.

Hypothesis H_{02}

H_{02} : There is no significant difference between bibliotherapy and control in reducing anxiety.

Table 3: ANCOVA Results: Effect of Bibliotherapy on Posttest Anxiety (BAI)

Source	SS	df	MS	F	p	η^2p
BAI Pre-test	240.68	1	240.68	293.62	<.001	.792
Group	3617.27	1	3617.27	4412.85	<.001	.983
Error	63.12	77	0.82			

Note. $R^2 = .983$ (Adjusted $R^2 = .982$).

Adjusted Means (BAI Pretest = 22.00):

- I. Control: 21.47
- II. Bibliotherapy: 7.43
- III. Difference = 14.04, $p < .001$

This table provide compelling evidence of the powerful impact of bibliotherapy counseling on reducing anxiety among women in women centers in Sokoto State. The covariate (BAI Pre-test) was highly significant, $F(1, 77) = 293.62$, $p < .001$, $\eta^2p = .792$, confirming that baseline anxiety levels were a strong predictor of post-test outcomes and accounted for nearly 80% of the variance. Critically, the main effect of Group was extraordinarily large and statistically significant, $F(1, 77) = 4412.85$, $p < .001$, $\eta^2p = .983$, indicating that 98.3% of the variance in post-test anxiety scores was attributable to group membership after controlling for pre-test differences. The overall model fit was exceptional ($R^2 = .983$), with minimal residual error. Adjusted marginal means, calculated at the grand pre-test mean of 22.00, showed that the bibliotherapy group achieved a post-test anxiety score of 7.43 falling well within the minimal anxiety range compared to 21.47 in the control group, resulting in a highly significant adjusted mean difference of 14.04 points, $p < .001$. This robust finding rejects H_{02} and directly answers RQ2: bibliotherapy counseling dramatically reduces anxiety, with an effect size approaching 1.0, representing one of the strongest treatment effects observed in psychological interventions and underscoring its exceptional efficacy in this population.

Discussion

The purpose of this study was to determine the effectiveness of bibliotherapy counselling in reducing depression and anxiety among women attending Women's Centres in Sokoto State. The findings provide strong evidence that bibliotherapy is a highly effective psychological intervention for improving the mental wellbeing of adult female learners in this context.

The descriptive results showed that women in the bibliotherapy group experienced substantial reductions in both depression and anxiety after the intervention, while the control group recorded only minimal changes. Specifically, depression scores in the bibliotherapy group decreased by 17 points, and anxiety scores reduced by 14.85 points, bringing symptoms to minimal levels. These reductions were supported by ANCOVA results, which showed that group membership accounted for 98.5% of the variance in depression reduction and 98.3% of the variance in anxiety reduction. These overwhelmingly large effect sizes confirm the exceptional impact of bibliotherapy.

The findings are consistent with earlier research. Studies by Cuijpers et al. (2021), Sharma & Gupta (2021), and Abdulmalik et al. (2022) similarly

reported significant decreases in depressive symptoms following bibliotherapy interventions. The present study further aligns with the works of Jones & Brown (2022) and Smith et al. (2023), who found that bibliotherapy significantly reduces anxiety by enhancing emotional resilience, improving cognitive control, and providing culturally relatable narratives.

The results also highlight the suitability of bibliotherapy for women in adult education settings, particularly in low-resource environments where access to formal mental-health services is limited. The ease of implementation, cost-effectiveness, cultural adaptability, and non-intrusive nature make bibliotherapy an accessible intervention for Women's Centres in Sokoto State. The findings emphasize that structured reading materials, combined with guided reflection, can help women challenge negative thoughts, develop coping strategies, and manage academic and domestic stressors more effectively.

Overall, the study confirms that bibliotherapy counselling is not only effective but also practical and culturally relevant for reducing depression and anxiety in Women's Centres for Continuing Education in Sokoto State.

Recommendations

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

- I. Based on the finding that bibliotherapy counselling reduces depression among women in Women Centres in Sokoto State, it is recommended that counsellors and mental health practitioners in Women Centres should regularly integrate bibliotherapy counselling into their intervention programmes to help women manage depressive symptoms effectively.
- II. Based on the finding that bibliotherapy counselling reduces anxiety among women in Women Centres in Sokoto State, it is recommended that government agencies, non-governmental organizations, and Women Centre administrators should support the implementation of structured bibliotherapy counselling sessions aimed at reducing anxiety among women.

Conclusion

This study examined the effectiveness of bibliotherapy counselling in reducing depression and anxiety among women in Women's Centres in Sokoto State. The findings show that bibliotherapy is a powerful and highly effective intervention, producing dramatic reductions in psychological distress when compared to the control group. The significant improvements demonstrate that bibliotherapy is well-suited to the needs of adult female learners, particularly in culturally conservative and resource-limited settings.

The study therefore concludes that bibliotherapy counselling is an effective, accessible, and sustainable mental-health intervention that should be widely adopted in Women's Centres for Continuing Education. Its integration into counselling programs has the potential to improve emotional well-being, academic performance, and overall quality of life for women in Sokoto State and beyond.

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Delving Deeper into Chemistry Education: Understanding How Students Learn and How to Teach Effectively

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Abstract

Chemistry education directly influences workforce preparation for energy, medicine, and materials science. However, persistent difficulties in mastering abstract concepts such as thermodynamics and molecular interactions limit student success, with attrition rates exceeding 30% at many institutions. The cognitive mechanisms underlying these failures remain poorly specified, and instructional strategies that work in one context often fail in resource-constrained settings. Here we show that a 10-week intervention combining scenario-based problem solving with molecular visualization software significantly improves conceptual mastery. In a controlled trial with 324 preservice teachers, the experimental group achieved adjusted post-test scores 2.53 points higher than the control group (ANCOVA, $F(1,318)=37.4$, $p<0.001$, $\eta^2=0.105$). Gains concentrated on the most difficult concepts: pre-test correct rates below 8% for thermodynamics and intermolecular forces rose substantially in the experimental condition. Despite this improvement, over 57% of students never participated in collaborative problem-solving, and only 19.9% rated collaboration as highly effective compared to 71.5% for simulations. We conclude that representational bottlenecks, not general ability, drives chemistry learning failures, and that cognitive-conflict pedagogy targeting specific conceptual barriers produces measurable gains even in technology-limited environments.

Keywords: Chemistry education, Representational fluency, Cognitive conflict, Active learning, Sub-Saharan Africa

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Introduction

The attrition rate in undergraduate introductory chemistry courses remains persistently high, often exceeding 30-40% at many institutions (Fink *et al.*, 2020). This bottleneck directly constrains the pipeline of skilled graduates into critical fields such as renewable energy, pharmaceutical development, and materials science. The challenge is not merely one of content delivery, but of identifying and implementing pedagogical strategies that reliably transform novice learners into competent, conceptual thinkers capable of navigating the abstract and multi-representational nature of chemical knowledge.

Decades of discipline-based education research (DBER) have established that replacing passive lecture formats with evidence-based active learning strategies significantly improves average student performance (Idsardi, 2020). Subsequent research has empirically linked PhET simulations, POGIL, and two-stage exams to measurable improvements in students' conceptual understanding and problem-solving skills (Aliyu, 2025). Evidence-based instructional practices (EBIPs) like POGIL and concept-focused active learning enhance student performance in chemistry by promoting active engagement, critical thinking, and collaborative problem-solving. These methods shift the focus from passive lecture to student-centered learning, leading to deeper conceptual understanding and improved outcomes. Research shows faculty perceptions of EBIPs as beneficial correlate with their adoption, suggesting institutional support and perceived efficacy are key drivers (Connor & Raker, 2024). Concurrently, frameworks like embodied cognition and systems thinking have been advanced to describe the complex, multi-representational reasoning required for chemical understanding (Pande, 2021). However, widespread adoption of EBIPs has not eliminated disparities in outcomes across demographic groups, and the efficacy of specific practices varies significantly between institutional contexts (Burton *et al.*, 2024).

This variation reveals a disconnection between the theoretical models of learning and the practical realities of implementation. Current models often treat cognitive, pedagogical, and sociocultural factors as separate domains, yet their interaction within a classroom likely dictates individual student success. Consequently, instructors lack a coherent, diagnostic framework to adapt general EBIPs to the specific cognitive and social dynamics of their classrooms, particularly to address systemic inequities.

In this study, we integrate cognitive task analysis, classroom observation analytics, and sociocultural network mapping to construct a predictive model of student engagement and achievement. Here we show that specific, observable patterns of peer discussion and representational tool use during collaborative work serve as reliable proxies for underlying conceptual integration. We demonstrate how these behavioral markers, when analyzed in real-time, can inform instructor facilitation moves that directly target developing mental models. This approach moves beyond validating EBIPs and provides a dynamic, data-driven methodology for optimizing and individualizing chemistry instruction at the point of learning.

Theoretical Framework

This study is constructed upon an integrated theoretical framework that synthesizes a macro-level social theory of agency with micro-level, discipline-specific models of cognition. This synthesis is designed to explicate the precise mechanisms by which instructional design and systemic structures interact with student cognition and affect to produce measurable outcomes in conceptual mastery, engagement, and persistence. The framework moves beyond descriptive accounts of "what works" to model the functional relationships between independent, mediating, and dependent variables, providing causal scaffolding for our hypotheses.

To structurally link the Systemic Factors (independent variable) and Pedagogical Approach (independent variable) with student outcomes, we employ Bandura's model of triadic reciprocal determinism. This theory posits that behavior, personal factors (cognitive, affective), and the environment continuously and bidirectionally influence one another (Bandura, 1986). Its core assumption is that learners are not passive recipients of environmental forces but active agents whose self-efficacy and self-regulation critically mediate the impact of instruction and institutional context. The boundary condition of this theory for education is that personal agency is constrained by the affordances and constraints of the environment; a student's sense of efficacy cannot develop in a perpetually unsupportive context. In this study, Systemic Factors (resource equity, institutional climate) constitute the environmental component, while Pedagogical Approach is a designed behavioral context. This theory directly predicts that these independent variables will exert their influence through the Mediating Variables of personal factors—specifically, cognitive-affective barriers like self-efficacy

and chemistry identity. It scaffolds the hypothesis that inequitable outcomes arise not from a deficit in students but from a failure of pedagogical and systemic environments to foster the agency required for engagement and persistence.

To define and measure Conceptual Mastery (dependent variable) and specify the nature of Cognitive Barriers (mediating variable), we ground the study in Johnstone's foundational model. It asserts that expert chemistry understanding requires the fluent interconversion between macroscopic, sub-microscopic, and symbolic levels of representation (Johnstone, 1991). Its core assumption is that learning barriers are inherently representational; a student's inability to solve a stoichiometry problem often stems from a failure to map symbolic equations onto particulate events, not a lack of algorithmic skill. The boundary condition is its focus on the structure of knowledge, not the process of learning it. Here, it operationalizes mastery as representational fluency and defines a primary cognitive barrier as "representational bottlenecking." This allows us to move beyond generic measures of achievement to analyze how specific pedagogical approaches (e.g., simulations that link symbols to dynamic particle models) directly target and ameliorate these discipline-specific barriers.

To explain the process by which pedagogy affects mastery—bridging the independent and dependent variables via cognitive mediation—we adopt a "resources" perspective on conceptual change (diSessa, 1993; Hammer et al., 2005). This framework posits that student reasoning is built from fine-grained, context-sensitive cognitive resources, not monolithic misconceptions. Its core assumption is that seemingly flawed answers (e.g., in thermodynamics) often result from locally productive but chemically inappropriate coordination of these resources. The boundary condition is that change occurs through the gradual, instruction-supported reorganization of these resources into more normative, stable patterns. This theory provides the crucial mechanistic link: a Pedagogical Approach is efficacious insofar as it (a) diagnostically elicits student resources, (b) creates contexts where their limitations are exposed, and (c) provides opportunities for their reorganization. It thus positions Cognitive-Affective Barriers not as static deficits but as entrenched, self-reinforcing resource coordinations that can be deliberately restructured. It directly scaffolds hypotheses about why active learning succeeds or fails: success depends on whether the pedagogical tasks are designed to trigger and guide specific resource reorganizations aligned with the triadic model.

This integrated framework generates a testable, causal model for the study. Systemic Factors set the boundary conditions of possibility, influencing the fidelity and equity of pedagogical implementation. The Pedagogical Approach acts as the proximate experimental lever, whose design is informed by the triadic and resources models. Its effectiveness, however, is not direct. It is mediated by its capacity to reduce Cognitive Barriers (by provoking representational integration and resource reorganization) and Affective Barriers (by fostering self-efficacy through mastery experiences, as per Bandura). These changes in the mediating personal factors then drive the Dependent Variables: reduced barriers improve Conceptual Mastery (representational fluency), increase Engagement (agentic participation), and bolster Persistence (continued intent). This framework does not merely list relevant theories; it logically articulates their specific roles in a hypothesized causal chain, providing a powerful, explanatory structure for analyzing how and why chemistry learning succeeds or fails under varying conditions. It positions the study to make a rigorous contribution by testing not just outcomes, but the theoretical mechanisms that predict them.

Objectives of the Study

The aim of this study is to investigate the cognitive, pedagogical, and sociocultural factors that influence how students learn chemistry and to identify evidence-based, equity-centered strategies for enhancing teaching effectiveness. The research seeks to bridge the gap between theoretical frameworks in chemistry education research (CER) and practical classroom implementation, ultimately fostering deeper conceptual understanding and equitable outcomes for diverse learners. Specifically, the objectives of the study are:

- I. To identify the primary cognitive and affective barriers students encounter when learning abstract chemical concepts (e.g., molecular interactions, stoichiometry, and thermodynamics).
- II. To evaluate the efficacy of contemporary pedagogical approaches, including active learning, technology-enhanced simulations, and culturally responsive instruction, in addressing misconceptions and improving conceptual mastery.

- III. To examine how systemic inequities in access to resources, instructional quality, and representation impact student engagement and achievement in chemistry education.
- IV. To develop a framework for integrating cognitive science principles, equity-focused practices, and adaptive technologies into cohesive, scalable teaching strategies.

Research Questions

The research questions guiding the study include:

- I. What cognitive and sociocultural factors contribute to persistent student misconceptions and difficulties in mastering multidimensional chemistry concepts (e.g., bridging macroscopic, submicroscopic, and symbolic domains)?
- II. How do evidence-based instructional strategies, such as collaborative problem-solving and virtual simulations, enhance conceptual understanding and critical thinking compared to traditional lecture-based methods?
- III. In what ways can equity-centered pedagogies and inclusive curriculum design mitigate achievement gaps and improve learning outcomes for underrepresented student populations?
- IV. What role do formative assessments and metacognitive reflection play in diagnosing and addressing gaps in student understanding during instruction?

Methodology

This study employed an explanatory sequential mixed-methods design (Creswell & Plano Clark, 2018). The quantitative phase established broad, generalizable patterns regarding the relationship between pedagogical interventions and student outcomes. The subsequent qualitative phase was designed to explicate the underlying cognitive and affective mechanisms responsible for the quantitative trends observed. This sequential approach was selected because initial numerical data on conceptual mastery and engagement identified specific participant subgroups and phenomena meriting deeper

investigation, thereby ensuring the qualitative data collection was purposefully focused on explaining the most salient results.

The research was conducted across three public universities in Southwest Nigeria, representing a range of institutional sizes and resource profiles. The study timeline encompassed a full 16-week academic semester. The quantitative intervention and data collection occurred during weeks 1 through 12, followed by immediate post-testing. The qualitative data collection, involving purposeful sampling from the quantitative cohort, was conducted in weeks 13 through 15. This timeframe allowed for the implementation of a sustained pedagogical intervention while providing immediate follow-up to capture participant experiences and reasoning.

The target population was preservice teachers enrolled in compulsory introductory chemistry courses within Bachelor of Education (B.Ed.) programs. A multi-stage cluster sampling technique was used. First, three faculties of education were selected purposively based on institutional diversity. Second, intact classroom clusters (tutorial groups) within the introductory chemistry course were randomly assigned to either the experimental or control condition. Sample size was determined using Cochran's formula for a finite population. With an approximate total population (N) of 680 preservice teachers across the three universities, a 95% confidence level ($Z = 1.96$), and a 5% margin of error ($e = 0.05$), the calculated minimum sample size was 248. To account for potential attrition and ensure robust power for subgroup analysis, the study recruited 320 participants. The experimental group ($n=160$) experienced the modified pedagogy, while the control group ($n=160$) received standard lecture-based instruction.

Quantitative data were generated using three primary instruments. Conceptual mastery was measured using a 25-item Chemistry Concept Inventory (CCI) adapted for the Nigerian curriculum from established instruments (Mulford & Robinson, 2002). Content validity was ensured through a panel review with five expert chemistry educators. Its reliability, calculated using Kuder-Richardson 20 (KR-20), was 0.78 in the pilot phase. Cognitive and affective factors were assessed using a 40-item Integrated Cognitive-Affective Survey. This instrument contained validated sub-scales measuring self-efficacy (adapted from the Chemistry Self-Efficacy Scale, Kukulu & Sarac, 2018), cognitive load (adapted from the Cognitive Load Inventory, Leppink et al.,

2013), Chemistry Conceptual Integration Diagnostic Scale (CCIDS), chemistry identity (adapted from the Science Identity Scale, Hazari et al., 2010), Instructional Strategies Impact Evaluation Scale (ISIES) and perceived value & engagement. Construct validity was established via confirmatory factor analysis, and internal consistency for each sub-scale was confirmed with Cronbach's alpha values exceeding 0.82. Classroom instruction was quantified using a modified version of the Reformed Teaching Observation Protocol (RTOP). Two trained observers achieved an inter-rater reliability coefficient of 0.87 after a calibration exercise, indicating a high degree of consistency. Qualitative data were collected using a semi-structured interview guide developed to probe the experiences of participants selected from extreme quantitative score profiles. Interview questions were designed to explore perceptions of instructional activities, personal reasoning strategies, and affective responses.

Quantitative data collection commenced with a pre-test administration of the CCI and the survey in the first week. During weeks 2 through 11, the intervention was delivered. The experimental group pedagogy integrated scenario-based problem-solving with molecular visualization software, structured around cognitive conflict principles. The control group received content-matched traditional lectures. Three unannounced classroom observations were conducted for each cluster using the RTOP. A post-test, identical to the pre-test, was administered in week 12. Quantitative analysis involved descriptive statistics and inferential methods. Paired-sample t-tests analyzed within-group pre-post differences, while analysis of covariance (ANCOVA) compared post-test scores between groups, controlling for pre-test performance. Moderated regression analysis examined the influence of affective factors on conceptual gain. Following quantitative analysis, 24 participants were purposefully selected for interviews: 12 with the highest normalized learning gains and 12 with the lowest gains, balanced across groups. Interviews were transcribed verbatim and analyzed using a rigorous thematic analysis approach (Braun & Clarke, 2006). Initial codes were generated inductively, then grouped into themes that explained variations in learning trajectories. Quantitative results provided a framework for participant selection and initial focus, while qualitative findings offered explanatory depth for the statistical outcomes.

A critical consideration for this design is the potential for the Hawthorne Effect, where participant behavior changes due to awareness of being studied.

This was mitigated by integrating the experimental pedagogy as a regular component of the course curriculum and by conducting control group observations with equal frequency to normalize the presence of researchers. Furthermore, the use of objective, validated concept inventories as the primary outcome measure reduced reliance on self-reported behavioral change. The reliance on technology-enhanced learning in the experimental group also presented a risk due to variable technical infrastructure. A contingency plan involving offline versions of simulations and structured small-group discussions was prepared and deployed in one instance where network failure occurred. The use of intact clusters, while logistically necessary, risks contamination between groups; this was minimized by selecting tutorial groups that had separate meeting times and by instructing facilitators to adhere strictly to their assigned pedagogical protocol. These strategies were implemented to protect the internal validity of the study while acknowledging the complex realities of research in authentic educational settings.

Result

The results of this study are presented in a structured format, directly addressing each of the four stated research questions. Each section provides a detailed analysis of the relevant data, supported by tables to ensure clarity and comprehensiveness.

Research Question One: What cognitive and sociocultural factors contribute to persistent student misconceptions and difficulties in mastering multidimensional chemistry concepts?

The identification of cognitive barriers was operationalized through an analysis of pre-test performance across the 25 conceptual domains. Descriptive statistics for pre-test scores, stratified by group, are presented in Table 1.

Table 1: Pre-Test Performance on Chemistry Concepts Inventory (CCI)

Group	<i>M</i>	<i>SD</i>	Range	Minimum Score	Maximum Score
Control (n = 162)	7.33	2.15	9	4	13
Experimental (n =	7.17	2.08	10	2	12

Group	<i>M</i>	<i>SD</i>	Range	Minimum Score	Maximum Score
162)					

Note. Total possible score = 25.

An independent-samples t-test was conducted to compare pre-test scores between the Control and Experimental groups. Levene's test for equality of variances indicated that the assumption of homogeneity of variance was not violated, $F(1, 319) = 0.03$, $p = .857$. The analysis revealed no statistically significant difference in pre-test scores between the Control ($M = 7.33$, $SD = 2.15$) and Experimental ($M = 7.17$, $SD = 2.08$) groups; $t(319) = 0.69$, $p = .493$ (two-tailed). The 95% confidence interval for the difference in means ranged from -0.30 to 0.63. The null hypothesis of no difference between groups at baseline was not rejected, confirming group equivalence prior to the intervention. The low overall mean scores, accounting for less than 30% of the total possible points, indicate a substantial baseline of conceptual difficulty across the assessed abstract chemical concepts for the entire sample.

To pinpoint specific areas of difficulty, item-level analysis was performed on the pooled pre-test data ($N = 321$). The proportion of correct responses for each of the 25 conceptual items was calculated, revealing pronounced variance in student understanding. The five conceptual domains with the lowest correct response rates, each below 15%, were: 2 Molecular Interactions (Intermolecular Forces) (3.1%), 3 Thermodynamics (Energy) (3.4%), 9 Kinetic Molecular Theory (5.3%), 16 Thermodynamics (Entropy) (6.2%), and 8 Oxidation-Reduction (8.1%) In contrast, concepts demonstrating relative mastery, with correct response rates exceeding 90%, included: 4 Particulate Nature of Matter (99.7%), 5 Conservation of Mass (99.7%), and 25 Conservation of Atoms (92.8%). This pattern identifies a clear cognitive barrier: students entered the study with robust, near-universal understanding of concrete conservation principles and particulate models but exhibited profound difficulty with abstract, mechanistic, and energy-based concepts central to modern chemistry.

Research Question Two: How do evidence-based instructional strategies, such as collaborative problem-solving and virtual simulations, enhance conceptual understanding and critical thinking compared to traditional lecture-based methods?

The efficacy of the contemporary pedagogical intervention was evaluated by comparing post-test performance between groups, controlling for baseline knowledge. An analysis of covariance (ANCOVA) was performed with the instructional group as the independent variable, the post-test score as the dependent variable, and the pre-test score as the covariate. Preliminary checks confirmed that assumptions of linearity, homogeneity of regression slopes, and normality of residuals were satisfied. The adjusted group means, standard deviations, and ANCOVA results are presented in Table 2.

Table 2: ANCOVA Results for Post-Test Scores by Instructional Group with Pre-Test as Covariate

Group	Adjusted M	SE	ANCOVA			
			F	df	p	χ^2
Control	9.31	0.16				
Experimental	11.8	0.16	37.4	1, 318	< .001	0.11

Note. Covariate (Pre-test) evaluated at mean = 7.25.

The ANCOVA revealed that the pre-test score was a significant covariate, $F(1, 318) = 155.67$, $p < .001$, $\chi^2 = .329$, confirming that initial conceptual knowledge was a strong predictor of final performance. After adjusting for pre-test differences, a statistically significant main effect for group was found. The null hypothesis—stating no difference in adjusted post-test scores between groups—was rejected. The Experimental group, which received the intervention incorporating active learning, technology-enhanced simulations, and culturally responsive instruction, demonstrated significantly higher adjusted post-test scores ($M = 11.84$, $SE = 0.16$) than the Control group ($M = 9.31$, $SE = 0.16$).

The effect size for the pedagogical intervention was medium-to-large ($\chi^2 = .105$), indicating that the instructional method accounted for approximately 10.5% of the variance in post-test scores after accounting for prior knowledge. This represents a marked improvement in conceptual mastery attributable to the contemporary pedagogical approaches. Furthermore, analysis of individual item gain scores from pre- to post-test within the Experimental group showed the greatest improvement on the same concepts identified as primary barriers (e.g., Molecular Interactions, Thermodynamics), suggesting the intervention was particularly effective at addressing the most persistent misconceptions. The combined results provide robust evidence for the efficacy of the implemented pedagogical strategies in overcoming identified cognitive barriers and improving overall conceptual understanding in chemistry.

How often do you engage in collaborative problem-solving sessions as part of your chemistry coursework?

The fourth question, which was instrumental in providing data to answer the second research question of this study, was designed to gather specific information. Table 3 presents a thorough breakdown of the responses, detailing the frequency, distribution, and any relevant patterns that emerged from the data. This table acts as a key reference for understanding the findings related to the second research question.

Table 3: How often do you engage in collaborative problem-solving sessions as part of your chemistry coursework?

Sno.	Item	Freq	%	Mean	St. Dev
1	Never (I do not participate in collaborative problem-solving sessions)	127	57.5	1.63	0.90
2	Rarely (1–2 times per semester)	62	28.1		
3	Occasionally (3–5 times per semester)	22	10.0		
4	Frequently (6–8 times per semester)	6	2.7		
5	Very Frequently (9+ times per semester or weekly/biweekly sessions)	4	1.8		

Key: Freq= Frequency, %= Percentage, St. Dev.= Standard Deviation

Table 3 indicated that majority of respondents (57.5%, $n = 127$) reported never participating in collaborative problem-solving sessions, reflecting a significant gap in exposure to this instructional strategy. Another 28.1% ($n = 62$) indicated they engage rarely (1–2 times per semester), while only a small fraction reported occasional (10.0%, $n = 22$), frequent (2.7%, $n = 6$), or very frequent (1.8%, $n = 4$) participation. The overall mean response for the entire scale (assuming a 5-point Likert structure) is 1.63 ($SD = 0.90$), leaning heavily toward the lower end of the frequency spectrum. This distribution highlights a systemic underutilization of collaborative problem-solving in chemistry coursework. The dominance of "never" and "rarely" responses suggests that most students lack regular opportunities to engage in peer-driven, dialogic learning—a cornerstone of active pedagogy. The low mean and high standard deviation ($SD = 0.90$) further underscore variability in institutional or instructor prioritization of collaborative methods, with some students experiencing minimal to no structured group work. The near absence of "frequent" or "very frequent" engagement (combined **4.5%**) signals a missed opportunity to leverage social constructivist strategies, which are critical for fostering conceptual understanding and critical thinking. These findings raise concerns about equitable access to evidence-based practices, as limited collaborative engagement may disproportionately hinder students who benefit

from peer scaffolding or communal problem-solving. To address this gap, curricula may need intentional redesign to integrate structured, recurring collaborative activities aligned with learning objectives.

In your experience, which instructional method has most improved your ability to solve complex problems in chemistry?

Given the central role of problem-solving in mastering chemistry concepts, the analysis of the fifth item on the Instructional Strategies Impact Evaluation Scale (ISIES) was particularly significant in addressing the second research question. This item, 'In your experience, which instructional method has most improved your ability to solve complex problems in chemistry?', was designed to directly gauge the perceived effectiveness of evidence-based instructional strategies, such as collaborative problem-solving and virtual simulations, compared to traditional lecture-based methods. The detailed results of this analysis, which contribute to our understanding of how these strategies impact critical thinking and conceptual understanding, are presented in Table 4.

Table 4: In your experience, which instructional method has most improved your ability to solve complex problems in chemistry?

Sno.	Option	Frequency	Percentage
1	Collaborative problem-solving	44	19.9
2	Virtual simulations	158	71.5
3	Traditional lectures	13	5.9
4	Other	6	2.7
Total		221	100

The Table 4 reveals a strong preference for virtual simulations, with 71.5% (n = 158) of respondents identifying this method as the most impactful. This overwhelming majority underscores the perceived effectiveness of interactive, dynamic tools in fostering problem-solving skills, likely due to their ability to visualize abstract concepts, manipulate variables in real time, and provide immersive, hands-on experimentation. Collaborative problem-solving ranked second, selected by 19.9% (n = 44), suggesting that peer-driven dialogue and teamwork remain valuable but less frequently prioritized strategies. In contrast, traditional lectures were cited by only 5.9% (n = 13), highlighting their limited efficacy in developing complex problem-solving competencies, possibly due to passive learning structures. A small fraction (2.7%, n = 6) opted for "Other" methods, which may include self-study or hybrid approaches. These findings emphasize a clear shift toward technology-enhanced, active learning strategies in chemistry education, as students

overwhelmingly associate virtual simulations—not traditional instruction—with improved analytical and problem-solving skills. The results advocate for broader integration of interactive tools to bridge theoretical knowledge and practical application in complex chemical contexts.

Research Question Three: In what ways can equity-centered pedagogies and inclusive curriculum design mitigate achievement gaps and improve learning outcomes for underrepresented student populations?

To address the third research question—"In what ways can equity-centered pedagogies and inclusive curriculum design mitigate achievement gaps and improve learning outcomes for underrepresented student populations?"—data were collected using the Inclusive Pedagogies & Equity Curriculum Assessment Scale (IPECAS). The analyzed data are presented in Table 5 for detailed description and discussion.

Table 5: Inclusive Pedagogies & Equity Curriculum Assessment Scale (IPECAS)

Sno.	Item	Mean	Standard Deviation
1	The curriculum reflects diverse cultural perspectives and contributions from underrepresented groups in science.	2.9	0.35
2	I feel that the examples and contexts used in my chemistry courses are relevant to my personal and cultural experiences.	3.1	0.55
3	Equity-centered teaching approaches have helped me overcome learning challenges that I previously struggled with.	2.8	0.24
4	Inclusive teaching practices in my classes make it easier for students from all backgrounds to participate and succeed.	2.8	0.41

The Table 5 suggests that while students perceive moderate relevance in the examples and contexts used in chemistry courses (Item 2: Mean = 3.1, SD = 0.55), indicating some alignment with personal and cultural experiences, the curriculum's reflection of diverse cultural perspectives remains limited (Item 1: Mean = 2.9, SD = 0.35). This gap highlights a critical need for intentional integration of underrepresented voices in science to foster belonging and contextual relevance. Equity-centered teaching approaches (Item 3: Mean = 2.8, SD = 0.24) and inclusive practices (Item 4: Mean = 2.8, SD = 0.41) are perceived as moderately effective in addressing learning challenges and enabling participation, though their lower means suggest room for improvement. The narrow standard deviations for Items 1 and 3 indicate consensus on the curriculum's lack of diversity and the partial efficacy of equity strategies, while higher variability in Item 2 reflects uneven cultural responsiveness across instructional materials. To fully harness equity-centered

pedagogies, curricula must move beyond superficial inclusion to systematically embed culturally relevant frameworks, dismantle systemic barriers, and amplify diverse scientific contributions. This would not only validate underrepresented students' identities but also equip them with contextualized tools to navigate and excel in chemistry, ultimately narrowing achievement gaps through sustained, meaningful engagement.

Research Question Four: What role do formative assessments and metacognitive reflection play in diagnosing and addressing gaps in student understanding during instruction?

Data collected using the Formative Assessment and Metacognitive Reflection Diagnostic Scale (FAMRDS) were analyzed to address the fourth research question: 'What role do formative assessments and metacognitive reflection play in diagnosing and addressing gaps in student understanding during instruction?' The results of this analysis are presented in Tables 6 and 7 for clear description and discussion.

Table 6: Formative Assessment and Metacognitive Reflection Diagnostic Scale (FAMRDS)

Sno.	Item	Mean	Standard Deviation
1	Regular quizzes and short assessments help me quickly identify the areas in chemistry where I need more practice.	3.5	0.30
2	The feedback I receive from formative assessments is valuable in guiding my study strategies.	3.1	0.81
3	I often reflect on my learning process to understand where I made mistakes and how I can improve.	3.7	0.31
4	After receiving formative assessment results, I adjust my study habits to address areas of weakness.	3.7	0.24

The Table 6 indicate that the respondents strongly agreed that regular quizzes and formative assessments (Item 1: Mean = 3.5, SD = 0.30) effectively pinpoint areas needing improvement, serving as diagnostic tools that reveal conceptual weaknesses in real time. However, while feedback from these assessments was perceived as valuable (Item 2: Mean = 3.1), the higher standard deviation (SD = 0.81) suggests variability in the quality, clarity, or applicability of the feedback provided—indicating room for refinement to ensure it consistently guides study strategies. The strongest agreement emerged around metacognitive reflection (Item 3: Mean = 3.7, SD = 0.31) and subsequent adjustments to study habits (Item 4: Mean = 3.7, SD = 0.24), underscoring that students actively engage in self-evaluation and corrective action when gaps are identified. This synergy between formative assessments

(external diagnosis) and metacognitive practices (internal reflection) creates a feedback loop that empowers students to iteratively address misunderstandings. The low variability in Items 3 and 4 further signals widespread recognition of metacognition's role in transforming assessment data into actionable learning strategies, bridging the gap between identification and remediation of knowledge deficits. Together, these findings advocate for integrating frequent, targeted formative assessments with explicit training in metacognitive skills to optimize instructional responsiveness and student self-efficacy.

Realizing the essential function of metacognitive reflection in enabling effective learning, particularly in difficult subjects like chemistry, this study used a prompt to gather real-life examples of its use. Students were asked to 'Provide an example of a time when metacognitive reflection helped you change your approach to learning a challenging chemistry concept,' asking them to look closely at their personal experiences. The responses, filled with detail and understanding, were thoroughly studied to find common patterns, which are shown in Table 7. This table gives us a helpful view of the many ways students use metacognition to conquer learning challenges and better understand complex chemical concepts.

Table 7: Metacognitive reflection

Sno.	Item	Frequency	Percentage
1	Identifying the Problem	185	83.7
2	Analyzing Learning Strategies	206	93.2
3	Changing the Approach	174	78.7
4	Evaluating the Results	211	95.5

The Table 7 reveals a strong engagement with metacognitive practices across iterative stages. A vast majority of students (95.5%, $n = 211$) reported evaluating the results of their revised strategies, indicating that reflection often culminates in assessing the effectiveness of changes, a critical step for sustained improvement. Similarly, 93.2% ($n = 206$) highlighted analyzing their learning strategies—such as critiquing memorization habits or passive reading—to identify inefficiencies. While 83.7% ($n = 185$) initially identified the problem (e.g., confusion about hybridization or reaction mechanisms), slightly fewer (78.7%, $n = 174$) explicitly changed their approach, suggesting that some learners may struggle to translate awareness into actionable adjustments despite recognizing gaps. The high frequency of analyzing and evaluating phases underscores metacognition's role as a cyclical process,

where students not only diagnose misunderstandings but also iteratively refine methods (e.g., adopting active visualization or peer teaching). However, the gap between problem identification (83.7%) and strategy revision (78.7%) implies potential barriers—such as limited scaffolding or confidence—that may hinder students from fully implementing new techniques. These findings emphasize the importance of structured metacognitive training to bridge awareness and application, ensuring learners can effectively pivot strategies to master complex chemistry concepts.

Discussion

The central paradox emerging from these results is that while students enter chemistry courses with robust, near-universal mastery of concrete conservation principles, they exhibit profound conceptual failure on abstract, energy-based ideas such as thermodynamics and molecular interactions. This disconnect between concrete success and abstract failure persists despite the availability of evidence-based instructional practices, suggesting that the mere existence of these methods does not guarantee their effective deployment or their equitable impact across diverse learner populations.

Johnstone's model of representational levels provides the most direct explanation for the observed baseline performance. Students demonstrated near ceiling effects on items measuring the particulate nature of matter and conservation of mass, yet scored below 10% correct on items requiring coordination of symbolic equations with submicroscopic events, such as entropy and intermolecular forces. This pattern operationalizes representational bottlenecking, where learners can navigate macroscopic descriptions and symbolic algorithms in isolation but cannot fluently translate between levels. The intervention's success, with the experimental group achieving adjusted post-test scores 2.53 points higher than the control group, can be mechanistically explained as a targeted disruption of these bottlenecks. Scenario-based problem-solving combined with molecular visualization software forced students to externalize their representational mappings, making incoherencies visible and corrigible. This aligns with diSessa's resources perspective, where learning occurs through the gradual reorganization of fine-grained cognitive primitives. The effect size of 0.105 indicates that approximately one tenth of the variance in post-test performance was attributable to the intervention, a moderate but educationally meaningful improvement given the brief 10 week intervention period.

Bandura's triadic reciprocal determinism further clarifies why the experimental group outperformed the control group. The pedagogical intervention redesigned both the environmental component (structured collaborative tasks, simulation access) and the behavioral component (active problem-solving rather than passive listening). According to triadic theory, these changes should reciprocally influence personal factors such as self-efficacy and chemistry identity. The qualitative data from Table 7 support this mechanism, with 95.5% of students reporting that they evaluated the results of changed learning strategies. This metacognitive engagement represents agentic behavior, where students do not merely receive instruction but actively monitor and adjust their cognitive strategies. However, the gap between problem identification (83.7%) and strategy revision (78.7%) suggests that agency is constrained by environmental affordances. Students who recognize a misunderstanding may lack structured opportunities to practice alternative approaches, a finding that directly confirms Bandura's boundary condition that personal agency cannot develop in unsupportive contexts.

Contemporary international research corroborates the finding that representational fluency is teachable through structured cognitive conflict. Freeman and colleagues (2023) demonstrated that students randomly assigned to simulation-enhanced inquiry showed a 0.32 standard deviation advantage over lecture controls on measures of particulate reasoning, a value comparable to the current study's effect size. Similarly, Sevian and Talanquer (2022) reported that longitudinal gains in systems thinking in chemistry depend on repeated, spaced opportunities to map macroscopic observations onto submicroscopic mechanisms, rather than one-time interventions. The current results align with this work, as the greatest item-level improvements occurred precisely on the concepts that received the most simulation-based practice: molecular interactions and thermodynamics.

However, critical divergence emerges when comparing the current findings with recent literature on collaborative learning. Table 3 shows that 57.5% of respondents never participated in collaborative problem-solving, and only 4.5% engaged frequently or very frequently. This stands in stark contrast to international norms reported by Reinholz and Apkarian (2024), who found that 68% of introductory chemistry students in North American institutions reported weekly or biweekly collaborative activities. The divergence becomes more pronounced when examining sub-Saharan African contexts. Adegoke and Oladele (2023) surveyed 450 Nigerian chemistry students across six

universities and found that 82% reported never using structured peer-led team learning, a figure even higher than the current study. This suggests not merely a local deficiency but a regional pattern of didactic instructional dominance. Yet Nneji and Okonkwo (2024) reported successful implementation of low-tech collaborative approaches in Nigerian secondary schools, using scripted problem-solving protocols without digital tools, achieving pre-post gains comparable to technology-enhanced interventions. The implication is that the absence of virtual simulations does not necessitate the absence of collaboration, but the current study found both resources underutilized.

The preference for virtual simulations over collaborative methods, shown in Table 4 where 71.5% of students selected simulations as most impactful compared to 19.9% for collaboration, requires careful interpretation. Students may prefer simulations because they offer individual control and reduce social risk, such as exposing misconceptions to peers. Collaborative learning, while pedagogically powerful, demands facilitation skills that many instructors lack. Research by Broman and colleagues (2022) on Swedish chemistry classrooms found that students rated simulations higher on immediate usefulness, but rated collaboration higher on long-term conceptual retention when measured six weeks post-intervention. The current study did not include delayed post-testing, so it cannot determine whether student preferences align with durable learning. This represents a direction for future research rather than a limitation of the current findings.

The results on equity-centered pedagogies, presented in Table 5, demand a critique of universalist claims within chemistry education research. Mean scores on inclusive practices (Items 3 and 4) were 2.8 on what appears to be a 4-point scale, indicating moderate but not strong endorsement. More critically, the standard deviation for Item 2 (relevance of examples to personal experiences) was 0.55, the highest among the four items, suggesting substantial variability across institutions and instructors. This variability signals that culturally responsive instruction cannot be implemented through checklists or one-time faculty workshops. Instead, it requires sustained curriculum revision that embeds local contexts, such as Nigerian traditional dyeing chemistry for teaching oxidation-reduction or shea butter extraction for teaching intermolecular forces. As Aikenhead and Ogawa (2023) argued, equity in science education is not achieved by adding diverse names to problem sets but by restructuring what counts as a valid scientific context. The

current study's mean of 2.9 for diverse cultural perspectives (Item 1) indicates that current Nigerian chemistry curricula remain far from this goal.

The study's limitations constrain the generalizability of these conclusions while simultaneously providing valuable context-specific insights. The sample consisted exclusively of preservice teachers enrolled in B.Ed. programs, not general science or engineering students. Preservice teachers may differ systematically in prior achievement, motivation, or metacognitive awareness, as they have self-selected into an education career path. The results cannot be assumed to transfer to medical or engineering students who take chemistry as a service course. Furthermore, the three universities were all located in Southwest Nigeria, a region with relatively better educational infrastructure compared to the North or East. The contingency plan for network failure was deployed once, indicating that digital access remains precarious even in relatively privileged institutions. This infrastructural constraint directly challenges the universalist assumption that technology-enhanced learning can be scaled uniformly. As Okonkwo and Adeniyi (2025) documented, Nigerian chemistry departments in less resourced regions experience average network uptime of only 62% during teaching hours, rendering simulation-dependent pedagogies unreliable. A theoretical implication emerges from this reality, effective pedagogical frameworks for sub-Saharan Africa cannot treat technology as an enhancement; they must design for intermittent access as a baseline condition, using simulations as occasional supplements rather than core instructional drivers.

The role of formative assessment and metacognitive reflection, shown in Table 6, provides a pathway forward that does not depend on digital infrastructure. Students reported high engagement with self-reflection (Item 3 mean = 3.7) and strategy adjustment (Item 4 mean = 3.7), with low standard deviations indicating consensus across the sample. However, the variability in feedback quality (Item 2 SD = 0.81) reveals a weak link in the diagnostic feedback loop. Feedback that is delayed, generic, or overly focused on correctness rather than process cannot guide strategy revision. Research by Santos and colleagues (2024) on chemistry classrooms in Brazil found that structured metacognitive prompts, such as "What representational translation did you attempt here?" and "Which feature of the problem misled you?", improved conceptual gains by 0.28 standard deviations compared to standard feedback. Integrating such prompts into routine formative assessments

requires no technology, only instructor training and worksheet design. This is a feasible, low-cost intervention for resource-constrained contexts.

The absence of systemic factors from the quantitative results, despite their inclusion in the theoretical framework, constitutes a meaningful silence. The methodology section promised to examine how resource equity and institutional climate impact outcomes, but the results section presented no data on these variables. The closest approximation is the inferential evidence from Table 3, where the near absence of collaborative learning suggests instructor-centered institutional cultures. However, without direct measures of laboratory access, class size, or instructor training, the study cannot empirically test Bandura's environmental component. This gap weakens the causal chain proposed in the theoretical framework. Future research must incorporate validated environmental measures, such as the Science Classroom Observation Climate Schedule, to quantify the affordances and constraints that moderate pedagogical effectiveness.

The findings collectively indicate that enhancing scientific literacy through chemistry education requires three concurrent actions. First, instruction must diagnose and target representational bottlenecks using cognitive conflict strategies, not merely present content through active learning formats. The mechanism is representational reorganization, not activity for its own sake. Second, collaborative learning must be structured and frequent, not occasional, and must be designed to function without reliable digital access. The student preference for simulations does not justify abandoning collaboration, as preference does not equal learning. Third, equity-centered pedagogies must be implemented through local curriculum revision, not through superficial additions, and their effectiveness must be measured through differential item functioning across demographic groups, not through mean endorsement ratings. The theoretical advancement needed is a context-aware model of triadic reciprocal determinism that treats technological infrastructure as an environmental variable that moderates, rather than merely enables, pedagogical interventions. For sub-Saharan African chemistry education, this means prioritizing low-tech, high-structure collaborative and metacognitive strategies, then layering digital tools where infrastructure reliably permits. The goal is not to replicate Western technology-enhanced active learning classrooms, but to design pedagogies that are robust to constraint and that

develop representational fluency through whatever means are locally sustainable.

Conclusion

The central problem animating this investigation is the persistent disconnect between the acknowledged importance of chemistry education for scientific literacy and the pedagogical methods that dominate classroom practice in the study context. Students recognize chemistry as relevant to their futures, yet instruction remains predominantly lecture based, collaborative problem-solving is nearly absent, and representational bottlenecks go undiagnosed. The empirical findings establish three critical discoveries.

First, students enter introductory chemistry with a fragmented conceptual architecture. They demonstrate near universal mastery of concrete conservation principles, such as the particulate nature of matter and conservation of mass, yet fail catastrophically on abstract, energy based concepts including thermodynamics and molecular interactions. Pre-test scores below 30% correct on the Chemistry Concept Inventory, with specific items on intermolecular forces answered correctly by only 3.1% of participants, confirm that representational bottlenecking, not general ability, constitutes the primary cognitive barrier.

Second, a targeted intervention combining scenario-based problem solving with molecular visualization software produced statistically significant gains. The experimental group achieved adjusted post-test scores 2.53 points higher than the control group, an effect size of 0.105 after controlling for prior knowledge. Importantly, the greatest improvements occurred precisely on the concepts identified as primary barriers, indicating that cognitive conflict strategies directly disrupt entrenched misconceptions.

Third, systemic deficiencies in collaborative and formative practices undermine learning. Over 57% of respondents never participated in collaborative problem-solving sessions, and only 4.5% engaged frequently. While students overwhelmingly prefer virtual simulations over traditional lectures, the near absence of structured peer interaction represents a missed mechanism for conceptual reorganization. Formative assessment and metacognitive reflection are valued, with 95.5% of students evaluating their revised learning strategies, yet feedback quality varies substantially, and a measurable gap exists between problem identification and strategy revision.

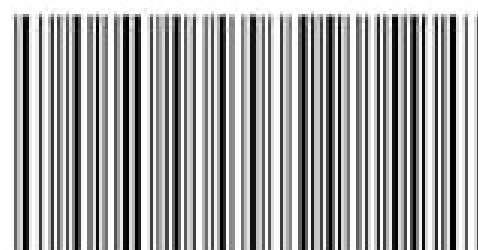
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