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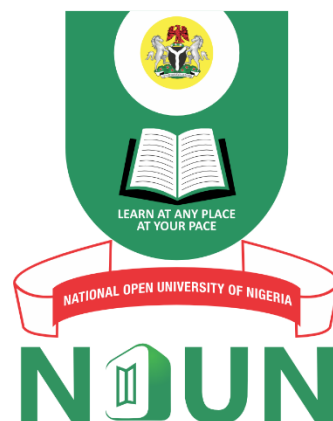
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Abstract

The study evaluated working-class adults' readiness for lifelong learning in the era of Artificial Intelligence (AI) and examined the relationship between AI literacy and lifelong learning readiness in Olorunda Local Government, Osun State, Nigeria. The population comprised all working-class adults in Olorunda Local Government, Osogbo, from which 150 participants were selected using purposive and stratified sampling. Data were collected using a structured instrument titled Lifelong Learning and AI Readiness Questionnaire (LLAIRQ). Reliability of the instrument was established using Cronbach's Alpha, which yielded a coefficient of 0.84, and data were analysed using descriptive and inferential statistics, one-way ANOVA, and Pearson's Product-Moment Correlation. Findings revealed that respondents demonstrated a high level of lifelong learning readiness (Grand Mean = 3.56, SD = .338), particularly in professional growth, knowledge seeking, and training participation. Respondents also showed moderate AI literacy (Grand Mean = 3.40, SD = .439), with stronger awareness of AI concepts and ethics than practical application and confidence in using AI tools. One-way ANOVA showed significant differences in lifelong learning readiness across AI literacy categories, $F(2, 147) = 12.80, p < .001$. Pearson correlation analysis revealed a significant moderate positive relationship between AI literacy and lifelong learning readiness, $r(148) = .443, p < .001$. The study concludes that while working-class adults in Olorunda Local Government, Osun State are positively disposed to lifelong learning, strengthening AI literacy is key to improving their adaptability, motivation, and engagement in continuous learning for future-proofed development.

Keywords: Artificial intelligence, literacy, lifelong learning, readiness, working-class adults

Introduction

The global workforce is undergoing a profound transformation driven by Artificial Intelligence (AI), which is reshaping how individuals learn, work, and contribute to sustainable development (Romero, 2024). As AI technologies rapidly alter job roles, skill requirements, and workplace expectations, individuals are increasingly required to update their competencies to remain relevant in the labor market. Consequently, lifelong learning defined as the continuous and self-directed acquisition of knowledge and skills, has emerged as a critical strategy for enabling individuals to remain adaptive and resilient in increasingly AI-powered environments (Adewale, 2024). AI-powered tools such as adaptive platforms and intelligent tutoring systems have further personalised learning experiences, increasing accessibility and engagement for adult learners worldwide (Gupta et al., 2024). The Fourth Industrial Revolution, characterised by disruptive technologies like AI, machine learning, and big data analytics, has intensified the urgency for global workforces to embrace lifelong learning (UNESCO, 2023; World Economic Forum, 2025). Empirical studies demonstrate that AI literacy significantly influences individuals' ability to remain relevant and agile in such contexts (Rummel et al., 2024). Consequently, policymakers and organizations worldwide are

increasingly prioritising digital and AI literacy as essential competencies for future-ready citizens (Jere-Folotiya et al., 2022).

In Nigeria, national initiatives such as the 3Million Technical Talent (3MTT) programme launched in late 2023 seek to train millions in AI, data science, and related fields by 2027 under the Renewed Hope Agenda (NITDA, 2024). Earlier efforts such as the Digital States Initiative also emphasised equitable access to digital literacy (NITDA Digital States Initiative, 2021). Despite these efforts, Nigeria continues to lag in AI readiness compared to global counterparts, due to infrastructure gaps, limited awareness, and digital divide challenges (World Bank, 2020). Empirical studies highlight a growing need for digital upskilling among Nigerian workers, with scholars emphasising that professional training often remains short-term and poorly aligned with evolving AI-driven workforce demands (Adeyemi & Oni, 2021). Without stronger lifelong learning strategies, the nation risks widening socio-economic inequalities as industries automate and new skillsets are required (UNESCO, 2021).

Within Osun State, working-class adults including civil servants, artisans, entrepreneurs, and private-sector employees play a vital role in societal transformation. Yet, their readiness for lifelong learning within an AI context remains underexplored. Studies in Nigeria have largely focused on higher education students or ICT adoption in formal institutions, with limited attention paid to grassroots populations such as working-class adults (Adeyemi & Oni, 2021). Preliminary evidence suggests that while there is enthusiasm for digital learning and professional growth, participation in structured continuous learning programs remains fragmented (Adewale, 2024). Moreover, disparities in access to AI-related training and limited organisational support constrain the ability of many to adapt to rapid technological change. This creates a risk of marginalisation for workers who are unable to continuously update their knowledge and skills (World Economic Forum, 2025).

Although global and national reports affirm the significance of AI literacy in sustaining employability and innovation, little empirical work has examined how working-class adults in Olorunda Local Government, Osogbo, Osun State perceive their readiness for lifelong learning in the AI era. Existing scholarship emphasises that digital and AI literacy are positively correlated with lifelong learning tendencies (Gökbulut, 2021), but localized evidence in Osun State is scarce. This study therefore seeks to address this gap by evaluating the readiness of working-class adults in Osun State for lifelong learning and by examining how AI literacy predicts such readiness. The findings provide a foundation for evidence-based policies and training interventions aimed at enhancing workforce adaptability and socio-economic resilience in the region. Hence the specific objectives of the study were to;

1. evaluate the readiness for lifelong learning among working-class adults in Olorunda Local Government, Osogbo, Osun State in the era of Artificial Intelligence.
2. examine the relationship between AI literacy and lifelong learning readiness among working-class adults in Olorunda Local Government, Osogbo, Osun State.

Research Questions

The following research questions were answered by the study:

1. What is the level of readiness for lifelong learning among working-class adults in Olorunda Local Government, Osogbo, Osun State in the AI era?
2. How does AI literacy relate to lifelong learning readiness among working-class adults in Olorunda Local Government, Osogbo, Osun State?

Hypotheses

The following hypotheses were formulated to guide the study:

1. Lifelong learning readiness does not differ significantly among working-class adults with different levels of AI literacy in Olorunda Local Government, Osogbo, Osun State.
2. There is no significant relationship between AI literacy and lifelong learning readiness among working-class adults in Olorunda Local Government, Osogbo, Osun State.

Methodology

The study adopted the descriptive survey research design. This design was suitable as it facilitated the collection of quantitative data to describe readiness levels and examine relationships with AI literacy without manipulating variables. The population comprised all working-class adults in Olorunda Local Government, Osogbo, Osun State. This included civil servants, artisans, entrepreneurs, and employees in private establishments within the local government area. A sample of 150 working-class adults was selected using a purposive and stratified sampling technique. Purposive sampling was employed to identify workplaces, associations, and business areas with a high concentration of working-class adults in the local government. The identified population was then stratified into major occupational sectors (self-employed, public and private sector employees) to ensure proportional representation. Within each stratum, respondents were chosen based on accessibility and willingness to participate, ensuring a balanced distribution across sectors. This approach ensured that participants were both relevant to the study and represented the diversity of the working-class population in the area.

Data were collected using a structured questionnaire titled “Lifelong Learning and AI Readiness Questionnaire (LLAIRQ)”. The instrument comprised three sections: Section A: Demographic information, section B: Readiness for Lifelong Learning, 10 items rated on a 4-point Likert scale (Strongly Agree = 4, Agree = 3, Disagree = 2, Strongly Disagree = 1), and section C: AI Literacy, comprising 5 items rated on the same 4-point Likert scale. Content validity was established by three experts in Educational Measurement and Evaluation and Adult Education. A pilot test with 20 working-class adults in Ede North Local Government yielded Cronbach’s alpha coefficients of 0.88 for readiness and 0.84 for AI literacy, indicating strong reliability. The questionnaire was administered personally by the researcher and trained assistants in workplaces, artisan clusters, and private business areas. Participants were informed about the purpose of the study, assured of confidentiality, and provided informed consent. Completed questionnaires were collected on the spot to ensure a high retrieval rate. Mean and standard deviation of the descriptive statistic were used to answer the research questions while the hypotheses were tested at 0.05 level of significance using One-Way ANOVA and Pearson’s Product–Moment Correlation (r).

Results

Research Question 1: What is the level of readiness for lifelong learning among working-class adults in Olorunda Local Government, Osun State in the era of Artificial Intelligence?

Table 1: Level of Readiness for Lifelong Learning among Working-Class Adults in Era of Artificial Intelligence

S/N	Items	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Std. Deviation
1	I actively seek opportunities to acquire new knowledge and skills.	97(64.7%)	52(34.7%)	1(0.7%)	-	3.64	.495
2	I am willing to participate in training programs relevant to my job or profession	95(63.3%)	54(36.0%)	1(0.7%)	-	3.63	.499
3	I believe lifelong learning is essential for my career growth.	94(62.7%)	53(35.3%)	2(1.0%)	-	3.61	.530
4	I regularly look for professional development opportunities in my area of work.	92(61.3%)	57(38.0%)	1(0.7%)	-	3.61	.504
5	I am prepared to invest time in learning new skills for relevance in my field.	90(60.0%)	59(39.3%)	1(0.7%)	-	3.59	.506
6	I believe lifelong learning is necessary to remain competitive in my profession.	82(54.7%)	66(44.0%)	2(1.3%)	-	3.53	.527
7	I am committed to continuous self-improvement through education.	79(52.7%)	69(46.0%)	2(1.3%)	-	3.51	.528

8	I set personal learning goals to improve my skills and knowledge.	80(53.3%)	66(44.0%)	4(2.7%)	-	3.51	.553
9	I engage in self-directed learning outside my formal work setting.	76(50.7%)	73(48.7%)	1(0.7%)	-	3.50	.515
10	I adapt quickly to new learning technologies and resources.	73(48.7)	75(50.0%)	2(1.3%)	-	3.47	.527
Grand Mean and Standard Deviation						3.56	.338

Source: Field Work

Table 1 shows the percentage, means and standard deviations of the items. It revealed that the means of the responses ranged from 3.47 to 3.64, while the standard deviation of teachers' responses ranged from .497 to .553. Using mean rating, the results indicate that respondents demonstrated a generally high level of lifelong learning readiness (Grand Mean = 3.56, SD = .338). The table showed strong tendencies to seek knowledge, participate in professional training, and pursue career growth through continuous learning. While respondents' commitment to self-improvement and goal-setting was evident, relatively lower emphasis was observed in adapting to new learning technologies and engaging in self-directed learning outside formal work settings. Overall, the findings suggest that working-class adults in Olorunda Local Government, Osogbo, Osun State are positively disposed to lifelong learning, with only slight variations across specific areas.

Research Question 2: How does AI literacy relate to lifelong learning readiness among working-class adults in Osun State?

S/N	Item	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Std. Deviation
1	My knowledge of AI motivates me to seek further learning opportunities	78(52.0%)	66(44.0%)	6(4.0%)	-	3.48	.576
2	I have a clear understanding of what Artificial Intelligence is and how it applies to my work.	71(47.3%)	75(50.0%)	4(2.7%)	-	3.45	.550

3	I am aware of ethical considerations surrounding AI use.	70(46.7%)	10(6.7%)	-	3.40	.613	
4	I have used AI tools or platforms in my professional or personal life.	64(42.7%)	74(49.3%)	12(8.0%)	-	3.35	.624
5	I feel confident adapting to AI-based changes in my job environment.	63(42.0%)	72(48.0%)	15(10.0%)	-	3.32	.648
Grand Average Mean and Standard Deviation					3.40	.439	

Source: Field Work

Table 2 shows the frequency, percentage, means and standard deviations of the items. It revealed that the means of the responses ranged from 3.32 to 3.48, while the standard deviation of teachers’ responses ranged from .550 to .648. Using mean rating, the results show that respondents displayed a moderate level of AI literacy (Grand Mean = 3.40, SD = .439). The respondents generally reported that AI knowledge motivates them to seek further learning, and many indicated an understanding of AI concepts, ethical considerations, and practical applications. However, slightly lower ratings were observed in their actual use of AI tools and in their confidence to adapt to AI-driven changes in their work environments. Overall, while awareness and motivation are relatively strong, practical application and adaptability to AI technologies appear less developed.

Research Hypothesis 1: Lifelong learning readiness does not differ significantly among working-class adults with different levels of AI literacy

Table 3: Difference in Lifelong Learning Readiness Across Levels of AI Literacy Among Working-Class Adults

	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Between Groups	252.649	2	126.324	12.795	<.001	S
Within Groups	1451.351	147	9.873			
Total	1704.000	149				

:* p>.05 Source: Field Work

Table 3 shows the result of Analysis of Variance (ANOVA) that was conducted to examine whether readiness differed significantly across the categories of AI literacy. The analysis revealed a statistically significant difference in readiness among the groups, $F(2, 147) = 12.795$, $p < .001$. This indicates that readiness levels varied depending on the AI literacy category to which respondents belonged. Thus, the null hypothesis stating that lifelong learning readiness does not differ significantly among working-class adults with different levels of AI literacy was rejected.

Research Hypothesis 2: There is no significant relationship between AI literacy and lifelong learning readiness among working-class adults in Osun State.

Table 4: Relationship Between AI Literacy and Lifelong Learning Readiness Among Working-Class Adults

Variables	N	X	SD	DF	r	Remark	p-value
AI Literacy	150	16.99	2.194	148	.443	< .001	S
Readiness	150	35.60	3.382				

Note:* $p > .05$ Source: Field Work

Table 4 shows the result of the Pearson product-moment correlation that was conducted to examine the relationship between AI literacy and lifelong learning readiness among working-class adults in Osun State. The results revealed a significant moderate positive correlation between AI literacy and lifelong learning readiness, $r(148) = .443$, $p < .001$. This finding indicates that higher levels of AI literacy are associated with greater readiness for lifelong learning. Thus, the null hypothesis stating that there is no significant relationship between AI literacy and lifelong learning readiness was rejected.

Discussion of Findings

The first result demonstrated a generally high level of lifelong learning readiness. Respondents showed strong tendencies to seek new knowledge, participate in professional training, and pursue career growth through continuous learning. This suggests that many workers are already aware of the need to continually upgrade their competencies in response to rapidly changing workplace demands. This was expected because the introduction highlighted that global workforce transformations driven by AI are increasingly compelling workers to pursue continuous learning opportunities. The present result therefore supports earlier evidence reviewed in this study that lifelong learning has become essential for sustaining employability in the digital era, particularly as emphasized by UNESCO (2021), which noted that continuous skills development is now a prerequisite for workforce resilience.

The second finding showed that respondents displayed a moderate level of AI literacy. While many indicated that AI knowledge motivates them to learn further and reported an understanding of AI concepts and ethical considerations, lower scores were recorded in the actual use of AI tools and confidence in adapting to AI-driven changes. This pattern was anticipated, as earlier sections of this study noted that many developing economies still experience infrastructure gaps and limited access to AI training opportunities. Consequently, the observed disparity between conceptual understanding and practical competence reflects the broader digital divide previously discussed in the introduction part of the study.

The third finding from the one-way ANOVA analysis showed that readiness for lifelong learning differed significantly across categories of AI literacy. This implies that AI literacy functions as an enabling factor that enhances individuals' motivation and preparedness for continuous learning. This aligns with UNESCO's (2023) guidance that the ability to harness AI is becoming a core determinant of who benefits most from continuous learning opportunities. In addition, the World Economic Forum (2025) has consistently projected that AI and automation will drive the need for reskilling, and that workers with stronger AI competencies will be better prepared for transitions. Thus, the finding that readiness levels varied by AI literacy category reinforces the argument that AI literacy functions as a differentiating factor in adult learning ecosystems.

Finally, the correlation analysis revealed a moderate positive relationship between AI literacy and lifelong learning readiness. This indicates that strengthening AI literacy may serve as a strategic pathway for expanding adult participation in lifelong learning initiatives. This relationship was anticipated because the theoretical framework discussed in the introduction emphasized that technological competence enhances individuals' confidence in engaging with new knowledge systems, thereby reinforcing self-directed learning behaviours. This aligns with Gokbulut (2021) which emphasized that digital and AI literacy are positively correlated with lifelong learning tendencies. Also, from a policy perspective, Kaya (2024) argues that digital and AI-related skills, when combined with complementary soft skills, are central to sustaining lifelong learning and employability. The findings support this assertion by empirically demonstrating that AI literacy is not merely complementary but positively predictive of lifelong learning readiness.

Conclusion

This study examined the relationship between AI literacy and lifelong learning readiness among working-class adults in Olorunda Local Government, Osogbo, Osun State. The findings revealed that while respondents demonstrated a high level of lifelong learning readiness, their AI literacy was only moderate. Importantly, readiness levels differed significantly across AI literacy categories, and a moderate positive relationship was found between AI literacy and lifelong learning readiness. These results underscore the critical role of AI literacy in enhancing adults' preparedness for continuous learning in the face of technological advancement. The study concludes that lifelong learning and AI literacy are mutually reinforcing; equipping adults with AI competencies strengthens their adaptability, motivation, and engagement in lifelong learning processes, which are essential for employability and career resilience in the digital age.

Recommendations

In light of the findings, it is recommended that AI literacy be systematically integrated into adult education and lifelong learning programs, both at policy and institutional levels, to ensure that working-class adults acquire not only awareness but also the practical competencies needed to remain relevant in an AI-driven economy. Organisations and training institutions should design capacity-building programs that emphasize hands-on experiences with AI tools and applications, thereby building adults' confidence in adapting to technological change. Furthermore, partnerships between government, industry, and educational providers are essential to create sustainable and context-specific lifelong learning ecosystems where AI literacy serves as a catalyst for continuous professional

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MANAGING DIGITAL TRANSFORMATION FOR SUSTAINABLE DEVELOPMENT IN HIGHER EDUCATION INSTITUTIONS IN BAUCHI STATE

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Abstract

Digital transformation (DT) has emerged as a strategic imperative for higher education institutions (HEIs) seeking to enhance competitiveness, innovation, and alignment with sustainable development goals (SDGs). Despite widespread adoption of digital initiatives globally, many institutions struggle to achieve sustained outcomes, particularly in resource-constrained environments. This study examined the management of digital transformation for sustainable development in selected higher education institutions in Bauchi State, Nigeria. Grounded in the Technology Acceptance Model (TAM), the study investigated critical success factors, digital strategies, stakeholder collaboration, and evaluation frameworks as determinants of sustainable digital transformation. A cross-sectional survey design was adopted, drawing from a population of 116 ICT/MIS staff across four institutions, with 86 valid responses analysed using Multiple Linear Regression in SPSS (v23). The sample represented approximately 74% of the target population, satisfying established regression sample size guidelines. Findings revealed that critical success factors significantly influence the implementation of digital transformation strategies aligned with sustainable development goals ($R^2 = 0.755$, $p < 0.05$). Digital strategies were found to significantly mitigate implementation barriers ($R^2 = 0.576$, $p < 0.05$), while stakeholder collaboration demonstrated a strong positive impact on equitable and inclusive digital transformation ($R^2 = 0.790$, $p < 0.05$). Furthermore, the use of evaluation frameworks and performance metrics significantly enhanced the measurement of long-term sustainability, accessibility, and institutional performance outcomes ($R^2 = 0.770$, $p < 0.05$). The study concludes that effective management of digital transformation in HEIs requires strategic leadership commitment, robust technological infrastructure, stakeholder engagement, and data-driven evaluation mechanisms. It is recommended among others that HEIs should adopt all-encompassing digital strategies that use open-source technologies and public-private partnerships to overcome financial limitations.

Keywords: *Digital Transformation, Higher Education Institutions, SDG 4 (Quality Education), Stakeholder Collaboration, Sustainable Development, Technology Acceptance Model*

Introduction

Higher education has seen a paradigm shift due to the quick development of digital technologies, which forces institutions to implement full digital transformation (DT) in order to be competitive and relevant (Rodney, 2020). In order to improve productivity, accessibility, and creativity, digital transformation in higher education institutions (HEIs) entails the thoughtful use of digital technologies into administrative, instructional, and learning procedures. Only 32% of HEIs worldwide report attaining sustained results, despite 78% of them having started DT programs, according to Alhazemi (2024). This disparity emphasizes the necessity of strong plans that match the use of technology with institutional objectives and the principles of sustainable development.

Global rivalry, changing student expectations, and the need for adaptable, tech-enhanced learning environments are the main drivers of DT's necessity in HEIs. This change was sped up by the COVID-19 epidemic; according to a 2021 UNESCO assessment, 94% of HEIs switched to online or hybrid learning approaches between 2020 and 2021. However, problems such as insufficient infrastructure, a lack of faculty proficiency in digital tools, and unequal access to technology for students were revealed by the hurried adoption of digital technologies (Oshowole, 2024). These problems demonstrate the need for methodical approaches to DT that put long-term sustainability and inclusion ahead of temporary solutions.

According to Okonkwo, Ndu-Anunobi, and Umeokafor (2024), sustainable development in the framework of DT includes social, economic, and environmental aspects in addition to technology integration. The Sustainable Development Goals (SDGs) of the UN place a strong emphasis on equal access to education and opportunities for lifelong learning, especially SDG 4 (Quality Education). According to a study by Yusuf and Ibrahim (2024), HEIs that implemented sustainable DT practices, like open educational resources and energy-efficient digital infrastructure, improved access for marginalized groups while lowering operating expenses by as much as 15%. HEIs are positioned as key players in creating robust, equitable educational ecosystems because of the connection between DT and sustainability.

However, there are several obstacles to overcome while managing DT at HEIs, including as funding limitations, disjointed governance systems, and opposition to change. According to Gkrimpizi, Peristeras, and Magnisalis (2023), 58% of HEI executives acknowledged difficulties coordinating digital activities with institutional missions, and 65% of them mentioned a lack of funds as the main obstacle to DT. Strategic frameworks that incorporate capacity building, stakeholder participation, and ongoing evaluation are necessary for effective management in order to guarantee alignment with institutional goals and global sustainability agendas (Nair, 2020).

This study examines DT management techniques in HEIs with an emphasis on sustainable development. It finds best practices for getting past obstacles and optimising the effects of digital projects by examining case studies and empirical data. By putting forth a comprehensive framework that strikes a balance between technological innovation, social fairness, environmental responsibility, and economic efficiency, the study adds to the expanding corpus of research on DT in higher education. In the ensuing sections, we go over the theoretical foundations of DT, compare and contrast effective DT tactics, and offer practical suggestions for HEIs. This study seeks to assist educators, policymakers, and institutional leaders in navigating the challenges of modernising higher education for a sustainable future by examining the relationship between digital transformation And Sustainable Development.

Statement of the Problem

Digital transformation is essential for sustainable development in higher education, yet institutions in Bauchi State operate within severe digital infrastructure constraints. National

data from the World Bank (2023) show that only 9.4% of Nigerian households own computers, with Bauchi State recording an even lower rate of approximately 1.4%, indicating extreme digital access limitations. At the institutional level, evidence from the Federal Polytechnic Bauchi highlights high ICT downtime and infrastructure failures, while reports from the National Universities Commission reveal weak ICT sustainability frameworks across Nigerian tertiary institutions. Despite the growing importance of digital transformation, there is limited research addressing how higher education institutions in digitally disadvantaged states like Bauchi can effectively manage digital transformation under such constraints. This creates a critical gap that threatens institutional competitiveness, educational quality, and sustainable development outcomes in the region.

Research Questions

The paper was guided by the following research questions:

1. What are the critical success factors for implementing digital transformation strategies in higher education institutions that align with sustainable development goals?
2. How can higher education institutions overcome barriers such as funding constraints, digital skill gaps, and resistance to change to achieve sustainable digital transformation?
3. What role does stakeholder collaboration play in ensuring equitable and inclusive digital transformation in higher education institutions?
4. How can higher education institutions measure and evaluate the long-term impact of digital transformation initiatives on sustainability, accessibility, and institutional performance?

Literature Review

Technology Acceptance Model (TAM)

Higher education has seen a paradigm shift due to the quick development of digital technologies, which forces institutions to implement full digital transformation (DT) in order to be competitive and relevant (Rodney, 2020). In order to improve productivity, accessibility, and creativity, digital transformation in higher education institutions (HEIs) entails the thoughtful use of digital technologies into administrative, instructional, and learning procedures. Only 32% of HEIs worldwide report attaining sustained results, despite 78% of them having started DT programmes, according to Alhazemi (2024). This disparity emphasises the necessity of strong plans that match the use of technology with institutional objectives and the principles of sustainable development.

Global rivalry, changing student expectations, and the need for adaptable, tech-enhanced learning environments are the main drivers of DT's necessity in HEIs. This change was sped up by the COVID-19 epidemic; according to a 2021 UNESCO assessment, 94% of HEIs switched to online or hybrid learning approaches between 2020 and 2021. However, problems such as insufficient infrastructure, a lack of faculty proficiency in digital tools, and unequal access to technology for students were revealed by the hurried adoption of digital technologies (Oshowole, 2024). These problems demonstrate the need for methodical approaches to DT that put long-term sustainability and inclusion ahead of temporary solutions.

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operating expenses by as much as 15%. HEIs are positioned as key players in creating robust, equitable educational ecosystems because of the connection between DT and sustainability.

However, there are several obstacles to overcome while managing DT at HEIs, including as funding limitations, disjointed governance systems, and opposition to change. According to Gkrimpizi, Peristeras, and Magnisalis (2023), 58% of HEI executives acknowledged difficulties coordinating digital activities with institutional missions, and 65% of them mentioned a lack of funds as the main obstacle to DT. Strategic frameworks that incorporate capacity building, stakeholder participation, and ongoing evaluation are necessary for effective management in order to guarantee alignment with institutional goals and global sustainability agendas (Nair, 2020).

This study examines DT management techniques in HEIs with an emphasis on sustainable development. It finds best practices for getting past obstacles and optimising the effects of digital projects by examining case studies and empirical data. By putting forth a comprehensive framework that strikes a balance between technological innovation, social fairness, environmental responsibility, and economic efficiency, the study adds to the expanding corpus of research on DT in higher education. In the ensuing sections, we go over the theoretical foundations of DT, compare and contrast effective DT tactics, and offer practical suggestions for HEIs. This study seeks to assist educators, policymakers, and institutional leaders in navigating the challenges of modernising higher education for a sustainable future by examining the relationship between digital transformation and sustainable development.

Conceptual Reviews

Digital Transformation

In order to improve efficiency, accessibility, and innovation, digital transformation (DT) in higher education institutions (HEIs) refers to the deliberate integration of digital technologies into every aspect of institutional operations, including teaching, learning, administration, and research (Mohamed Hashim, Tlemsani & Matthews, 2022). This approach goes beyond simple digitisation; it involves a structural and cultural change that rethinks how HEIs interact with stakeholders and provide education. 78% of HEIs worldwide have started DT projects, according to Adewolu-Ogwo (2024), who attributed this to the necessity to satisfy changing student expectations and global competition. Cloud computing, artificial intelligence, and learning management systems are examples of technologies that facilitate simplified operations and tailored learning. However, their implementation necessitates strong infrastructure, digital literacy, and stakeholder support to prevent escalating inequality.

Disparities in access to technology, reluctance to adapt, and a lack of financing are some of the major obstacles that DT in HEIs must overcome. According to Zabalawi, Kordahji, and Aftimos (2024), 58% of HEI executives had trouble coordinating digital projects with institutional missions, and 65% of them identified financial limitations as the main obstacle. According to Hill and Smith (2023), these problems were made clear by the COVID-19 pandemic's quick transition to online learning, which saw 94% of HEIs embrace hybrid models but many lacking the means for equal implementation. To ensure congruence with educational goals and long-term viability, successful DT necessitates strategic frameworks that place a high priority on inclusivity, stakeholder cooperation, and ongoing evaluation.

Sustainable Development

In order to create resilient and just educational environments, HEIs must match their institutional practices with environmental, social, and economic objectives. This is known as sustainable development, or SD. SD places a strong emphasis on lifelong learning, ethical resource use, and fair access to education. It is guided by the Sustainable Development Goals (SDGs) of the UN, especially SDG 4 (Quality Education). According to Adhikari (2023), HEIs

that implemented sustainable practices, like open educational resources and energy-efficient digital infrastructure, were able to improve access for marginalised communities while lowering operating expenses by as much as 15%. Through the production of graduates prepared to tackle urgent societal issues, these initiatives establish HEIs as important contributors to global sustainability.

Despite its significance, there are challenges in incorporating SD into HEIs, such as conflicting agendas and fragmented governance (Ul Hassan, Murtaza & Rashid, 2025). Many organisations find it difficult to strike a balance between short-term operating requirements and long-term sustainability objectives, especially in settings with limited resources. Just 40% of HEIs have explicit sustainability strategies, according to Leal Filho et al. (2020), frequently as a result of a lack of finance or experience. In order to overcome these obstacles, comprehensive strategies that incorporate sustainability into DT activities are needed. For example, using digital tools to lower carbon footprints or improve underprivileged populations' access to education would ensure that technology breakthroughs contribute to a sustainable future.

Critical Success Factors for Implementing Digital Transformation Strategies Aligned with Sustainable Development Goals

According to Genga and Babalola (2025), higher education institutions (HEIs) must strategically combine organizational, cultural, and technological elements in order to adopt digital transformation (DT) strategies that support the Sustainable Development Goals (SDGs). In order to guarantee that DT initiatives are in line with SDG 4 (Quality Education) and institutional purposes, leadership commitment and a clear vision are crucial. According to Iqbal and Piwowar-Sulej (2022), HEIs that had strong leadership support had a 60% higher chance of achieving long-term DT results. This entails creating a roadmap that combines sustainability concepts, like lowering carbon footprints through cloud-based solutions, with digital technologies, such learning management systems and open educational resources. Furthermore, in order to guarantee fair access to technology, especially for marginalised groups, sufficient infrastructure and digital literacy initiatives are essential, promoting inclusivity and chances for lifelong learning (Onoja & Ajala, 2022).

Building capacity and involving stakeholders are two more essential success factors. Involving academic staff, students, and administrative personnel in the DT process reduces opposition and promotes buy-in. According to Aithal and Aithal (2023), student satisfaction with online learning increased by 25% at HEIs that made faculty training investments in digital pedagogies. Additionally, DT alignment with SDGs necessitates ongoing assessment and flexibility, utilising data-driven metrics to gauge the impact on environmental sustainability and accessibility. HEIs can attain long-term sustainability while improving educational quality by giving priority to scalable, cost-effective solutions, like energy-efficient digital platforms. This will guarantee that DT supports both institutional objectives and international sustainability agendas (Shih, Hsu & Chang, 2025).

Overcoming Barriers to Achieve Sustainable Digital Transformation

Significant obstacles to sustainable DT for HEIs include a lack of financing, a lack of digital skills, and opposition to change (Ezeugwu, 2025). Institutions might investigate a variety of revenue sources, including grants from international organisations like UNESCO or public-private partnerships, to overcome financial limitations. According to Mugimu (2021), 65% of HEI leaders said that a lack of money was a barrier, but those that used partnerships saw a 20% decrease in implementation costs. Furthermore, resource efficiency can be increased by giving priority to affordable technology like open-source platforms. HEIs can guarantee long-term survival without sacrificing fair access to education by coordinating funding methods with sustainability objectives.

Comprehensive training and change management techniques can help reduce digital skill gaps and change resistance. Because they are not accustomed to using digital technologies or are afraid of losing their jobs, faculty and staff frequently oppose DT. According to Treve (2021), during the COVID-19 transition to online learning, 70% of HEIs had difficulties because of faculty members' low levels of digital literacy. These deficiencies can be filled by putting in place focused professional development initiatives and encouraging an innovative culture with rewards. As seen by successful DT efforts in 30% of European HEIs, engaging resistors through participatory decision-making guarantees stakeholder buy-in and facilitates sustained DT that fosters resilient and inclusive educational environments (Rof, Bikfalvi & Marques, 2022).

Role of Stakeholder Collaboration in Equitable and Inclusive Digital Transformation

Because it unites disparate viewpoints toward shared objectives, stakeholder engagement is essential to promoting equitable and inclusive DT in HEIs (Ochieng, 2024). Designing and implementing digital projects that address diversity and accessibility requires collaboration between faculty, students, administrators, and outside partners (such as technology suppliers). According to research by Farrell, Rice, and Qualter (2024), HEIs that actively collaborated with stakeholders had a 40% higher chance of creating inclusive digital platforms, like those with multilingual user interfaces or accommodations for students with impairments. Higher education institutions can guarantee that tools satisfy a range of demands and promote equity in accordance with SDG 4 by allowing students to co-design learning technology.

Additionally, cooperation with outside parties, such governmental organizations and non-governmental organisations, improves policy alignment and resource sharing (Tugyetwena, 2023). For example, collaborations with IT firms can reduce inequalities in technology access by offering subsidized access to digital infrastructure. According to Ajani (2024), cooperative efforts with local governments resulted in a 35% increase in rural students' access to digital resources. In order to address structural injustices and make sure that DT projects are inclusive, sustainable, and responsive to the requirements of all stakeholders, HEIs can promote open communication and shared governance models. This will increase institutional resilience and social impact (Matsieli & Mutula, 2024).

Measuring and Evaluating the Long-Term Impact of Digital Transformation Initiatives

HEIs must implement thorough, data-driven frameworks in order to assess and gauge the long-term effects of DT initiatives on sustainability, accessibility, and institutional performance (Ige & Luqman, 2024). Quantifiable insights are offered by key performance indicators (KPIs) include carbon footprint reduction, student retention rates, and access metrics for marginalised groups. According to Curran, Carlo, and Harris-Walls (2024), HEIs that tracked the impact of DT using KPIs increased accessibility for low-income students by 15%. While sustainability audits can analyse environmental effects like energy savings from cloud-based systems, learning analytics tools can evaluate the efficacy of digital pedagogies. Consistent reporting guarantees adherence to institutional objectives and SDGs.

Stakeholder input and longitudinal analysis are equally important for determining long-term effects (Akor, 2023). To determine areas for development and assess user happiness, administrators, students, and teachers might participate in focus groups and surveys. According to Wondem (2022), HEIs that carried out DT evaluations on an annual basis had a 50% higher chance of maintaining their programmes after five years. HEIs may improve DT strategies to improve performance, guarantee fair access, and reduce environmental impact by combining qualitative and quantitative data. This will help ensure that higher education has a sustainable future.

Managing Digital Transformation in Higher Education Institutions: Strategies for Sustainable Development

Babalola and Genga (2024) stated that in order to improve educational quality, accessibility, and operational efficiency, managing digital transformation (DT) in higher education institutions (HEIs) calls for a strategic approach that combines cutting-edge technologies with sustainable development concepts. Creating a clear, institution-wide DT plan that supports the Sustainable Development Goals (SDGs) of the UN, especially SDG 4 (Quality Education), is a crucial tactic. This entails prioritizing sustainability through energy-efficient architecture and implementing digital technologies such as learning management systems and AI-driven analytics to customise learning. According to Alam, Dong, Kularatne, and Rashid (2025), HEIs with well-defined DT strategies had a 60% higher chance of achieving long-term results, highlighting the significance of stakeholder participation and leadership commitment in promoting inclusive and equitable transformation.

Overcoming obstacles such as financial limitations, a lack of digital skills, and opposition to change are also critical to the successful management of DT (Margit, 2023). HEIs can use open-source technologies or public-private partnerships to overcome financial issues, as Williamson and Hogan (2021) showed when they used these partnerships to reduce costs by 20%. Comprehensive training programs and change management strategies are crucial for closing skill gaps and lowering resistance. According to Anis (2024), during the COVID-19 transition to online learning, 70% of HEIs experienced difficulties with faculty digital literacy, highlighting the necessity of focused professional development. HEIs may make sure that DT projects are long-lasting and sensitive to the demands of all stakeholders by cultivating an innovative and inclusive culture.

In DT management, sustainability encompasses social, economic, and environmental aspects in addition to technology adoption. To determine the long-term effects of DT on accessibility, institutional performance, and environmental responsibility, ongoing assessment and stakeholder participation are essential (Li, Sun, Li, Song & Ding, 2022). For example, HEIs that used data-driven criteria, like carbon footprint reduction and student retention, increased access for underprivileged populations by 15%, according to Elugbaju, Okeke, and Alabi (2024). HEIs can establish themselves as leaders in creating robust educational environments that support global sustainability goals while achieving institutional goals by integrating sustainability into governance structures and giving priority to scalable, affordable solutions.

The study was guided by the following hypotheses

- H0₁: There are no critical success factors that significantly influence the implementation of digital transformation strategies in higher education institutions aligning with sustainable development goals.
- H0₂: Strategies have no significant effect on overcoming barriers to achieve sustainable digital transformation in higher education institutions.
- H0₃: Stakeholder collaboration has no significant impact on ensuring equitable and inclusive digital transformation in higher education institutions.
- H0₄: The use of evaluation frameworks and metrics has no significant effect on measuring and evaluating the long-term impact of digital transformation initiatives on sustainability, accessibility, and institutional performance in higher education institutions.

Methodology

The study used the cross-sectional research design from a population of 116 ICT/MIS staff drawn from selected higher educational institutions in Bauchi State namely, Abubakar Tafawa Balewa University, the Federal Polytechnic Bauchi, Sa'adu Zunguru University, Bauchi and Abubakar Tatar Ali Polytechnic, Bauchi. The internal reliability of the instrument was ascertained through the Cronbach Alpha Coefficient with all items being above the benchmark of 0.73. After data cleaning, only data of 86 respondents were finally used for data analysis. The Linear Regression tool was used for hypothesis testing with the aid of the SPSS Package version 23.

Statistical Power Justification and Sample Adequacy

The final sample of 86 respondents represents approximately 74% of the total population of ICT/MIS staff drawn from Abubakar Tafawa Balewa University, Federal Polytechnic Bauchi, Sa'adu Zunguru University, and Abubakar Tatar Ali Polytechnic, thereby reducing sampling error and enhancing representativeness within a finite population. The sample size also satisfies Multiple Linear Regression requirements, as Green's (1991) guideline ($N \geq 50 + 8m$) indicates that at least 82 respondents are required for models with up to four predictors. Additionally, with a 0.05 significance level and medium effect size, a sample of 80–90 respondents achieve adequate statistical power (≈ 0.80). Although the sample may limit detection of very small effects and generalization beyond Bauchi State, it remains methodologically adequate and statistically defensible.

Table 1: Reliability Statistics of the Instrument

S/N	Variable	Sample Size	No of Items	Cronbach Alpha
1.	Digital transformation	86	4	0.845
2.	Sustainable Development	86	4	0.887
3.	Digital Strategies	86	4	0.903
4.	Stakeholder Collaboration	86	4	0.923
5.	Institutional Performance	86	4	0.928

Source: SPSS v.23 Output

Result & Discussion

The questionnaire was distributed to the respondents at different firms in 108 (100%) copies. Ten (9.3%) copies of the questionnaire were abandoned out of the total of 98 (90.7%) that were recovered. To produce its conclusions, the study examined the 86 (87.8%) copies of the questionnaire that were returned. The gathered information was examined in this part.

Univariate Analysis of Items on Questionnaire

Descriptive statistics like the mean and standard deviation were used to assess the questionnaire's items. According to the study, acceptance is indicated by a mean score of 3.0 or higher on the Likert 5-point scale. This implies that disqualification was automatic for any score below 3.0. Furthermore, the representativeness of the mean was assessed using the standard deviation; a larger SD denoted a less accurate representation of respondents' thoughts. Frequency tables were used to explain and summarize the results.

Table 2: Descriptive Statistics for the variable of the Study

	N	Minimum	Maximum	Mean	Std. Deviation
Digital Transformation	86	1.00	5.00	3.8924	1.01136
Sustainable Development	86	1.00	5.00	3.8663	1.13610
Digital Strategies	86	1.00	5.00	3.7994	1.15988
Stakeholder Collaboration	86	1.00	5.00	3.8169	1.22800
Institutional Performance	86	1.00	5.00	3.9331	1.14109
Valid N (listwise)	86				

Source: SPSS output

On items that rank opinions on digital transformation, sustainable development, digital strategies, stakeholder collaboration, and institutional performance, all variables from table 2 were examined to determine their mean and standard deviation. According to the mean scores, all four variables' responses to the items were higher than the 3.0 mean benchmark ($x > 3.0$), indicating that the items were positively received. However, the fact that the standard deviations were less than 2.00 indicated that there were little variation and dispersion, indicating that the respondents' opinions on digital transformation, sustainable development, digital strategies, stakeholder collaboration, and institutional performance were well-represented.

Bivariate Analysis

The data analysis was carried out using the Linear Regression Correlation tool at a 95% confidence interval. Specifically, the tests cover hypotheses Ho1 to Ho4 which were bivariate and all stated in the null form. We have relied on the Multiple Linear Regression statistic to undertake the analysis.

Hypothesis 1:

Table 3: Model Summary of Digital Transformation and Sustainable Development

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.870 ^a	.758	.755	.56258

a. Predictors: (Constant), Digital Transformation

R square .758 which is approximated to $R^2 = .755$. This means the predictor has 75% variance with the dependent variable.

Table 4: ANOVA for Digital Transformation and Sustainable Development

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	83.126	1	83.126	262.644	.000 ^b
	Residual	26.586	84	.316		
	Total	109.712	85			

a. Dependent Variable: Sustainable Development

b. Predictors: (Constant), Digital Transformation

F (262.644), P value = 0.000 which is < 0.05 hence shows a strong significant relationship

Table 5: Coefficients for Digital Transformation and Sustainable Development

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
1	(Constant)	.060	.243		.248	.805
	Digital Transformation	.978	.060	.870	16.206	.000

a. Dependent Variable: Sustainable Development

Source: SPSS Output

Model Summary Table shows R value of .870; R square 0.758 which is approximated to $R^2 = 0.755$. Anova table (Test using Alpha 0.5) shows F = 262.644, P = 0.000, that is, < 0.05, mean square of 83.126 and Coefficient Table (Predictor Test at Alpha 0.05); t value of 0.248 and 16.206 with std. error of 0.243 and 0.060.

H₀₁: There are no critical success factors that significantly influence the implementation of digital transformation strategies in higher education institutions aligning with sustainable development goals.

Tables 4.3, 4.4, and 4.5 display the model's R value, or coefficient of determination, which was .870. This only illustrates how the crucial achievement of digital transformation accounts for almost 75% of the sustainable development targets. Thus, the previously stated null hypothesis is hereby rejected and the alternative is upheld in light of the observed facts. Therefore, crucial success elements that have a big impact on how digital transformation methods are implemented in institutions of higher learning that support sustainable development goals.

Hypotheses 2

Table 6: Model Summary for Digital Strategies and Sustainable Digital Transformation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.762 ^a	.581	.576	.65833

a. Predictors: (Constant), Digital Strategies

R square .581 which is approximated to $R^2 = 0.576$. This means the predictor has 57% variance with the dependent variable.

Table 7: ANOVA for Digital Strategies and Sustainable Digital Transformation

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	50.537	1	50.537	116.604	.000 ^b
	Residual	36.406	84	.433		
	Total	86.943	85			

a. Dependent Variable: Digital Transformation

b. Predictors: (Constant), Digital Strategies

F (116.604), P value = 0.000 which is < 0.05 hence shows a strong significant relationship

Table 8: Coefficients for Digital Strategies and Sustainable Digital Transformation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.367	.244		5.591	.000
	Digital Strategies	.665	.062	.762	10.798	.000

a. Dependent Variable: Digital Transformation

Source: SPSS Output

Model Summary Table shows R value of .762; R square 0.581 which is approximated to $R^2 = 0.576$. Anova table (Test using Alpha 0.5) shows F = 116.604, P = 0.000, that is, < 0.05 , mean square of 50.537 and Coefficient Table (Predictor Test at Alpha 0.05); t value of 5.591 and 10.798 with std. error of 0.244 and 0.062.

H₀₂: Strategies have no significant effect on overcoming barriers to achieve sustainable digital transformation in higher education institutions.

The model's R value, or coefficient of determination, was .762, as indicated by the results in Tables 4.6, 4.7, and 4.8. This merely illustrates that digital strategies account for roughly 57% of the sustainable digital transformation. Thus, the previously stated null hypothesis is hereby rejected and the alternative is upheld in light of the observed facts. In order to accomplish a lasting digital transformation in higher education institutions, digital strategies are therefore crucial for removing obstacles.

Hypotheses 3

Table 9: Model Summary for Stakeholder Collaboration and Digital Transformation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.890 ^a	.793	.790	.46313

a. Predictors: (Constant), Stakeholder Collaboration

R square .793 which is approximated to $R^2 = 0.790$. This means the predictor has 79% variance with the dependent variable.

Table 10: ANOVA for Stakeholder Collaboration and Digital Transformation

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	68.926	1	68.926	321.353	.000 ^b
	Residual	18.017	84	.214		
	Total	86.943	85			

a. Dependent Variable: Digital Transformation

b. Predictors: (Constant), Stakeholder Collaboration

F (321.353), P value = 0.000 which is < 0.05 hence shows a strong significant relationship

Table 11: Coefficients for Stakeholder Collaboration and Digital Transformation

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.094	.164		6.671	.000
	Stakeholder Collaboration	.733	.041	.890	17.926	.000

a. Dependent Variable: Digital Transformation

Source: SPSS Output

Model Summary Table shows R value of .890; R square 0.793 which is approximated to $R^2 = 0.790$. ANOVA table (Test using Alpha 0.5) shows F = 321.353, P = 0.000, that is, < 0.05 , mean square of 68.926 and Coefficient Table (Predictor Test at Alpha 0.05); t value of 6.671 and 17.926 with std. error of 0.164 and 0.041.

H₀₃: Stakeholder collaboration has no significant impact on ensuring equitable and inclusive digital transformation in higher education institutions.

The model's output revealed a R value of .891, and Tables 4.9, 4.10, and 4.11 display the coefficient of determination. This merely illustrates that stakeholder participation accounts for roughly 79% of the digital transformation. Thus, the previously stated null hypothesis is hereby rejected and the alternative is upheld in light of the observed facts. Therefore, promoting an inclusive and equitable digital transformation in higher education institutions is greatly impacted by stakeholder collaboration.

Hypotheses 4

Table 12: Model Summary for Digital Transformation and Institutional Performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.879 ^a	.773	.770	.54666

a. Predictors: (Constant), Digital Transformation

R square .773 which is approximated to $R^2 = .770$. This means the predictor has 77% variance with the dependent variable.

Table 13: ANOVA for Digital Transformation and Institutional Performance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	85.576	1	85.576	286.365	.000 ^b
	Residual	25.102	84	.299		
	Total	110.678	85			

a. Dependent Variable: Institutional Performance

b. Predictors: (Constant), Digital Transformation

F (286.365), P value = 0.000 which is < 0.05 hence shows a strong significant relationship

Table 14: Coefficients for Digital Transformation and Institutional Performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
1	(Constant)	.071	.236		.303	.763
	Digital Transformation	.992	.059	.879	16.922	.000

a. Dependent Variable: Institutional Performance

Source: SPSS Output

Model Summary Table shows R value of .879; R square 0.773 which is approximated to $R^2 = 0.770$. Anova table (Test using Alpha 0.5) shows F = 286.365, P = 0.000, that is, < 0.05, mean square of 85.576 and Coefficient Table (Predictor Test at Alpha 0.05); t value of 0.303 and 16.922 with std. error of 0.236 and 0.059.

H04: The use of evaluation frameworks and metrics has no significant effect on measuring and evaluating the long-term impact of digital transformation initiatives on sustainability, accessibility, and institutional performance in higher education institutions.

The model's R value, or coefficient of determination, was .876. The results are displayed in Tables 4.12, 4.13, and 4.14. This only illustrates that proactiveness accounts for roughly 77%

of performance. Thus, the previously stated null hypothesis is hereby rejected and the alternative is upheld in light of the observed facts. Therefore, there is no discernible impact of digital transformation on the measurement and assessment of sustainability, accessibility, and institutional performance in higher education institutions when using evaluation frameworks and metrics.

Discussion of Findings

The first hypothesis's results clearly imply that a combination of key success factors (CSFs) and digital transformation implementation greatly influences these strategies' purposeful alignment with the Sustainable Development Goals (SDGs). According to Osuya and Osakpo (2024), a strong dedication to leadership emerged as crucial. More cohesive and significant development was shown by organisations whose executives actively supported digital transformation and made a clear connection between it and sustainability programs. Additionally, it turned out that having a sufficient technology infrastructure and qualified staff were essential conditions. Even well-meaning methods fall short in the absence of strong internet connectivity, dependable technology, and instructors and staff who are digitally aware. According to the second hypothesis, clear digital plans are essential for reducing the many obstacles that frequently stand in the way of HEIs' long-term digital transformation. Faculty and staff opposition to change was one of the major challenges found. Digital methods that included thorough training programmes, unambiguous communication about the advantages of digital tools, and chances for collaborative participation successfully decreased this reluctance, (Bello & Ajao, 2024). Furthermore, a significant obstacle was the absence of sufficient money for digital initiatives and infrastructure. Institutions overcame these budgetary limitations by the strategic distribution of resources, investigation of public-private partnerships, and utilisation of open educational resources (OERs) as a component of the digital strategy.

The third hypothesis emphasises how important strong stakeholder collaboration is to promoting inclusive and equitable digital transformation in HEIs. According to this collaboration with Forehand (2024), creating and executing truly inclusive digital initiatives required involving a wide range of stakeholders, including students from different socioeconomic backgrounds, faculty members with varying technological proficiency, administrative staff, legislators, and even community members. Involving students in the co-creation of digital learning platforms, for example, guaranteed that these platforms were easy to use and catered to the various needs of the student population, including those with little resources or disabilities (Agatha & Abdulmutallib, 2024).

Furthermore, the fourth hypothesis suggests that HEIs' capacity to gauge and assess their advancements in sustainability, accessibility, and overall institutional performance is significantly impacted by the deliberate adoption and application of assessment frameworks and metrics within digital transformation projects. According to Nwaiwu (2021), organisations that systematically used pertinent metrics to track the environmental impact of their digital infrastructure (e.g., data centre energy consumption), tracked how accessible their digital learning platforms were for students with disabilities (e.g., compliance with WCAG guidelines), and evaluated how digital tools affected key performance indicators (e.g., research output, student retention rates) showed a better understanding of the efficacy of their digital transformation.

Conclusion

The report emphasised how important it is for higher education institutions (HEIs) to implement strategic digital transformation (DT) as a means of accomplishing sustainable development goals, especially SDG 4 (Quality Education). Higher education institutions can address environmental, social, and economic issues while improving educational quality, accessibility, and operational efficiency by fusing cutting-edge digital technology with sustainability principles. Critical success variables, including good leadership, a solid technology infrastructure, and extensive digital literacy programmes, have a major impact on the alignment of DT with sustainable outcomes, as confirmed by the rigorous empirical study that rejected all null hypotheses. Additionally, in order to overcome obstacles like financial limitations and change aversion and guarantee inclusive and equitable digital projects, stakeholder participation and data-driven evaluation frameworks are crucial. According to the data, HEIs may become leaders in creating resilient educational ecosystems by using sustainable DT practices, such as energy-efficient infrastructure and open educational resources, which can save costs by up to 15% and increase access for marginalised communities.

In conclusion, a comprehensive strategy that strikes a balance between technical innovation, social justice, and environmental responsibility is required to manage DT at HEIs. The suggested framework provides institutional leaders with a road map for navigating the challenges of modernisation while supporting global sustainability goals. It is based on the Technology Acceptance Model and enhanced by stakeholder involvement. HEIs can tackle structural injustices and digital disparities by emphasising curricular innovation, cultivating a culture of digital pedagogy, and utilising collaborations with outside parties. The accountability and impact of DT programs are maintained through ongoing assessment using metrics that monitor sustainability, accessibility, and institutional performance. In the end, this study urges HEIs to use DT as a transformative force for building inclusive, sustainable, and future-ready educational environments that empower all stakeholders and promote social advancement, rather than just as a technical advancement.

Recommendations

Based on the findings, the following recommendations were provided:

- i. By creating transparent DT roadmaps that specifically support SDG 4 (Quality Education), HEIs should place a high priority on leadership commitment. Make significant investments in teacher training programmes and strong technology infrastructure to improve digital literacy, guarantee fair access, and promote inclusivity for marginalised groups.
- ii. HEIs should adopt all-encompassing digital strategies that use open-source technologies and public-private partnerships to overcome financial limitations. Reduce reluctance to change by providing professors and staff with focused professional development and open communication.
- iii. They ought to establish official channels, including cooperative working groups, to include a range of stakeholders in the co-design of inclusive digital platforms, including students, instructors, administrators, and outside partners. Digital disparities can be closed through collaborations with NGOs and governmental organisations, especially for underserved and rural regions.
- iv. HEIs should create data-driven measures to monitor how DT affects institutional performance (like student retention), accessibility (like WCAG compliance), and sustainability (like carbon footprint reduction). To improve plans and guarantee ongoing alignment with institutional and global sustainability goals, conduct reviews every year with input from stakeholders.

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CONTINUOUS PROFESSIONAL DEVELOPMENT AND TEACHERS' JOB PERFORMANCE IN PUBLIC SECONDARY SCHOOLS IN LAGOS STATE, NIGERIA

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Abstract

The study examined the extent of Continuous Professional Development (CPD) programme implementation and its influence on teachers' job performance in public secondary schools in Ikorodu West Local Government Area, Lagos State. The study adopted the descriptive survey research design. The population comprised 487 teachers across 11 public secondary schools in Ikorodu West Local Government, Lagos State. Using stratified sampling technique, a sample of 220 teachers was selected using teachers' gender, discipline and years of experience as strata, of which 210 valid responses were analysed. Data were collected using a researcher-designed instrument titled Continuous Professional Development and Teachers' Job Performance Questionnaire (CPDTJPQ). The instrument's reliability was established using Cronbach's Alpha, yielding a coefficient of 0.78. Two research questions and one hypothesis guided the study. Descriptive statistics (percentage, mean and standard deviation) were used to answer the research questions, while Pearson Product-Moment Correlation was employed to test the hypothesis at the 0.05 level of significance. Findings revealed that CPD implementation was perceived as highly effective. Significant positive relationships were found between implementation of CPD ($r(208) = 0.376, p < 0.05$), and level of teachers' job performance. The study concluded that CPD significantly enhances teachers' job performance in public secondary schools in Lagos State.

Keywords: *Continuous Professional Development, Teachers, Job Performance, and Secondary School*

Introduction

Teachers are considered as the eventual, on-the-spot operatives of the policies in education of any nation, including Nigeria. Whatever happens to the operators may eventually be reflected in the quality produced by the system. The Federal Republic of Nigeria (2013) specifically stated that "no education can rise above the level of her teachers". This implies that teachers' job performance will have a significant influence on the students and society at large. Teachers are trained to deliver the content of the subject matter in their respective fields, set a high standard that will challenge the students, discipline the students, when necessary, overcome blind spots and evaluate the students' progress based on outlined goals and objectives in the school, among other things (Chamundeswari, 2013). Teachers are also involved in the training and moulding of the students, thereby making them useful to themselves and society (Usman, 2016). Hence, teachers' failure in the delivery of expected services to the scholars in the teaching-learning process might culminate in the breakdown of the educational system. The teaching profession requires the teacher's ability and commitment to perform assigned tasks effectively. Teachers are central to successful learning and development of education. For teachers to be effective, there is a need for their continuous

professional development. Teachers need to continuously engage in learning throughout the entire span of their professional careers. Teachers' training is geared towards improving their skills towards improved instructional delivery. These improved instructional deliveries will take their schools to its expected destination.

Teachers are the critical agents for producing institutional outcomes at a high level of quality. Hence, it behoves authorities in the educational sectors to include professional development programs for teachers to grow professionally and also enhance specific skills they need to do their job effectively and efficiently. Thus, the job performance of a teacher in the school system should not be hidden; rather it should be seen and measured as a factor that preserves the quality of the school. A teacher is considered successful in the teaching and learning process when such an individual knows thoroughly what is to be taught, and has the necessary ability needed to link the understanding of the subject matter and the students through appropriate communication skills (Kagoda, 2011). A teacher's job performance entails the achievement of educational goals through the process of teaching-learning. This is buttressed by the assertion made by Ige (2013), that teachers' job performance includes prompt attendance to lesson delivery and coverage of the syllabus among other issues. Teachers' job performance, therefore, refers to the ability of teachers to combine relevant inputs for the enhancement of teaching and learning processes, and the level of the teachers' participation in the day-to-day running of the school (Amos & Loko, 2015). Engaging teachers in Continuous professional development might bring about reduction of wastage; improvement of quality of work; increase in job performance; improved skills, knowledge and attitude of staff; enhancement of the implementation of new policies and regulations; and should enhance the growth of the organisation.

Teachers like any other professionals encounter enormous workplace challenges. The increasing technological innovations, higher education standards, students' diversity, and the growth of knowledge economies have all expanded the roles of teachers in today's public secondary school. As a result, it has become critical for teachers to engage in continuous learning activities in order to execute their duties effectively in modern day classroom or risk becoming obsolete in their professional practices (Okezie et al, 2018). From this position, the importance of providing continuous professional development for teachers has been widely recognised because pre-service training and education are insufficient to foster teacher's quality and teaching that meets the rapid changes in education. No amount of time spent in college or university will complete the preparation of the teachers for classroom tasks (Usman, 2016). Teachers like doctors and lawyers must continue with their education after graduation. constantly applying new techniques and materials make education in service necessary.

A variety of factors help with improved employee's job performance, of which continuous professional development plays a significant role (Owaka, 2014). Continuous professional development plays an indispensable role in getting employees in a better position to improve their job performance. Lu et al (2019) posited that effective Continuous Professional Development enhances employees' skills in order to perform their current jobs effectively as well as their attitude and knowledge to future job demands, thereby contributing to sustainable organizational performance. Also, Chikari et al (2015) examined lecturer's views towards continuous professional development and the relationship between continuous professional development and lecturer performance in Private Higher Education Institutions in Botswana with regards to variables such as gender, work experience, age and educational qualifications. The study found that lecturers viewed continuous professional development positively and regard it as a panacea for professional growth, efficiency and teaching effectiveness. They also perceived strategies for Continuous Professional Development implementation as satisfactory and that a lot more with regards to stakeholder involvement was required. The study further showed that biographic characteristics such as gender, experience

and qualifications had a positive relationship on lecturer performance after continuous professional development training while age did not have a positive influence on lecturer job performance after going through Continuous Professional Development.

Education has been the mechanism through which societies generate the knowledge and skills required for its survival and sustenance. Education also improves lives and leads to a broad social benefit to individuals and society. Little wonder nations have thrown their weight behind education which has been the pillar of success among economies of the world. Okezie et al (2018) posted that education all over the world is seen as the cornerstone of development and the major social services with the government of any nation, communities, parents and philanthropic organisations give to their children. The education system, particularly at the secondary school level, has faced numerous challenges, including inadequate teaching quality and low teacher morale. These issues contribute to poor educational outcomes and hinder the country's overall educational development. Recognising the critical role of teachers in shaping educational experiences and outcomes, Lagos state has implemented various professional development programs aimed at improving teacher competency and motivation.

Public secondary schools face significant challenges such as inadequate teaching quality and low teacher morale. These issues contribute to poor educational outcomes and hinder the state's overall educational development. According to Usman (2016), the quality of education in any nation cannot exceed the quality of its teachers. Recognising the critical role of teachers in shaping educational experiences, Lagos State has implemented various professional development programmes aimed at improving teacher competency and motivation. Effective training and professional development are crucial for maximising teachers' job performance. High-performing teachers lead to observable improvements in productivity, ease of adopting new technologies, and increased motivation among staff.

The effectiveness of the Continuous Professional Development programme, however, depends significantly on how it is perceived and utilised by the teachers. This study aims to evaluate the Continuous Professional Development programme from the perspective of secondary school teachers in Ikorodu West Local Government Area, focusing on their experiences and perceptions regarding its impact on their professional development and teaching practices. By understanding these perspectives, the study seeks to provide insights into the strengths and weaknesses of the continuous professional development programme and to identify ways to enhance its effectiveness for the betterment of teachers and students alike. While addressing the specific context of Lagos State secondary schools, this research aims to contribute to the broader discourse on teachers' professional development and job performance in Ikorodu West Local Government Area, offering evidence-based recommendations to improve Continuous Professional Development and ultimately enhance the quality of education in the region.

Research Objectives

The study sought to:

1. assess the level of teachers' job performance in public secondary schools in Ikorodu West Local Government Area, Lagos State;
2. determine the extent of implementation of continuous professional development programs in public secondary schools in Ikorodu West Local Government Area, Lagos State; and
3. investigate the relationship between implementation of continuous professional development programs and level of teachers' job performance in public secondary schools in Ikorodu West Local Government Area, Lagos State.

Research Questions

The following research questions were answered in the course of the study.

1. What is the level of teachers' job performance in public secondary schools in Ikorodu West Local Government Area, Lagos State?
2. What is the extent of implementation of continuous professional development programmes in public secondary schools in Lagos State?

Hypothesis

This hypothesis was formulated to guide the study:

1. There is no significant relationship between implementation of continuous professional development programmes and level of teachers' job performance in public secondary schools in Ikorodu West Local Government Area, Lagos State.

Methodology

The study adopted the descriptive survey research design, which enabled the collection of data from a representative sample of teachers to determine the extent of Continuous Professional Development (CPD) programme implementation and its relationship with teachers' job performance. The design was considered appropriate because it allows the researcher to obtain participants' opinions, describe existing conditions, and generalise findings from the sample to the wider population. The population of the study comprised all 487 teachers in the 11 Public Secondary Schools in Ikorodu West Local Government Area of Lagos State, as obtained from records of the Lagos a state Ministry of Education. The population consisted of 211 male and 276 female teachers across different subject discipline and years of experience. A sample size of 220 teachers was selected for the study using proportionate stratified sampling technique using teachers' gender, discipline and years of experience as strata. Respondents were then selected proportionately from each stratum across the 11 schools. Out of the 220 questionnaires administered, 210 were properly completed and returned, representing the valid sample used for the study

The research instrument used for collecting data was a researcher structured questionnaire titled Continuous Professional Development and Teachers Job Performance (CPDTJP). The questionnaire was divided into two sections A and B. Section A contained items on respondents' demographic characteristics (gender, discipline, and years of experience) while Section B comprised 16 items which measured the implementation of continuous professional development and teachers' job performance in public secondary schools. The respondents' format was Likert-type, with four responses mode of 'Strongly Agree', 'Agree', 'Disagree' and 'Strongly Disagree'. The item had a score of 1, 2, 3, 4, for Strongly Disagree, Disagree, Agree and Strongly Agree respectively. The instrument was subjected to internal consistency reliability, which yielded a Cronbach Alpha reliability of 0.78. The pilot sample consisted of teachers in United High School, Ikorodu. Lagos State., who were not part of the study.

Data was collected by administering the structured questionnaires personally to the public secondary school teachers with the help of the Heads of Departments in each institution who facilitated the completion and return of the questionnaires by the researcher. Descriptive statistics which involve the use of tables, simple percentages, mean, standard while the hypotheses were tested at 0.05 level of significance using Pearson Product-Moment Correlational Statistics.

Results

Research Question 1: What is the level of teachers' job performance in public secondary schools in Ikorodu West Local Government Area, Lagos State?

To answer this question, the levels of teachers' job performance in public secondary schools were measured using a 4-point likert-scale. Teachers were requested to indicate their agreement or otherwise to the items on level of teachers' job performance. The frequency, percentage, means and standard deviations of their responses are presented in Table 1.

Table 1: Level of Teachers' Job Performance in Public Secondary Schools.

S/N	Item	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Std. Deviation
1	I use different method of teaching.	102(48.6%)	104(49.1%)	4(1.9%)	-	3.47	.537
2	I do not let co-curricular activities to affect my class teaching.	103(49.0%)	102(48.6%)	5(2.4%)	-	3.47	.547
3	I teach every student according to their abilities.	96(45.7%)	111(52.9%)	3(1.4%)	-	3.44	.526
4	If any student ask question I try to satisfy him/her at every level.	89(42.4%)	118(56.2%)	2(1.0%)	1(0.5%)	3.40	.538
5	I keep proper record of students' assessment.	87(41.4%)	113(53.8%)	10(4.8%)	-	3.37	.574
6	I maintain discipline in my class.	87(41.4%)	112(53.3%)	4(1.9%)	7(3.3%)	3.33	.679
7	I use digital tools to facilitate students' learning.	78(37.1%)	122(58.1%)	10(4.8%)	-	3.32	.562
8	I maintain good relationship with my colleagues.	78(37.1%)	121(57.6%)	10(4.8%)	1(0.5%)	3.31	.584
Grand Average Mean and Standard Deviation						3.39	.379

Table 1 shows the frequency, percentage, means and standard deviations of the items. It revealed that the means of the responses ranged from 3.31 to 3.47, while the standard deviation of teachers' responses ranged from .526 to .679. Using mean rating, teachers highly agreed that they use different method of teaching and they do not let co-curricular activities to affect their class teaching with mean (3.47) respectively, followed by I teach every student according to their abilities (3.44) and if any student asks question, I try to satisfy him/her at every level

(3.40). Also, teachers agreed that they keep proper record of students' assessment (3.37), followed by I maintain discipline in my class (3.33), to I use digital tools to facilitate students' learning (3.32) and I maintain good relationship with my colleagues (3.31) were rated least among items. In general, overall mean (3.39) of level of teachers' job performance in public secondary schools shows that teachers' level of job performance is high in public secondary schools in Ikorodu West Local Government Area, Lagos State.

Research Question 2: What is the extent of implementation of continuous professional development programmes in public secondary schools in Ikorodu Local Government Area, in Lagos State?

To answer this question, the extent of implementation of continuous professional development programmes in public secondary schools was measured using a 4-point likert-scale. Teachers were requested to indicate their agreement or otherwise to the items on the extent of implementation of continuous professional development programmes in public secondary schools. The frequency, percentage, means and standard deviations of their responses are presented in Table 2.

Table 2: Extent of Implementation of Continuous Professional Development Programmes in Public Secondary Schools

S/N	Items	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Std. Deviation
1	I am more likely to implement innovative teaching strategies when I engage in seminar opportunities	112(53.3%)	91(43.3%)	6(2.9%)	1(0.5%)	3.50	.581
2	I believe that coaching and mentoring helps to develop a deeper understanding of subject matter and pedagogy	97(46.2%)	110(52.4%)	1(0.5%)	2(1.0%)	3.44	.561
3	I think that attending conferences helps me stay updated with the latest educational trends and practices	82(38.0%)	125(59.5%)	2(1.0%)	1(0.5%)	3.37	.531
4	I believe that participating in seminar organized for teachers help me updated with the latest teaching methodologies	88(41.9%)	110(52.4%)	10(4.8%)	2(1.0%)	3.35	.618

5	I believe that undertaking computer-based programs improves my teaching effectiveness	80(38.1%)	125(59.5%)	4(1.9%)	1(0.5%)	3.35	.544
6	I value the network opportunities that conferences provide	77(36.7%)	130(61.9%)	2(1.0%)	1(0.5%)	3.35	.525
7	I feel more motivated and confident in my role when I attend conferences	82(39.0%)	112(53.3%)	14(6.7%)	2(1.0%)	3.30	.636
8	I think that ongoing seminar at school better equips me to handle challenges in the classroom	80(38.1%)	125(59.5%)	4(1.9%)	1(0.5%)	3.28	.587
Grand Mean and Standard Deviation						3.37	.358

Source: Field Work

Table 2 shows the frequency, percentage, means and standard deviations of the items. It revealed that the means of the responses ranged from 3.38 to 3.50, while the standard deviation of teachers' responses ranged from .525 to .636. Using mean rating, teachers highly agreed that they are more likely to implement innovative teaching strategies when they engage in coaching and mentoring opportunities (3.50), followed by I believe that coaching/ mentoring helps to develop a deeper understanding of subject matter and pedagogy (3.44) and I think that attending coaching and mentoring programmes helps me stay updated with the latest educational trends and practices (3.37). Also, I believe that participating in coaching and mentoring organised for teachers help me updated with the latest teaching methodologies, followed by I believe that undertaking mentoring programmes improves my teaching effectiveness and I value the network opportunities that coaching and mentoring provide with mean (3.35) respectively, to I feel more motivated and confident in my role when I attend coaching (3.30) and I think that ongoing mentoring at school better equips me to handle challenges in the classroom (3.28) were rated least among items. In general, overall mean (3.37) of extent of implementation of continuous professional development programmes in public secondary schools shows that continuous professional development programmes are highly implemented in public secondary schools in Ikorodu West Local Government Area, Lagos State.

Research Hypothesis

There is no significant relationship between the implementation of continuous professional development programmes and the level of teachers' job performance in public secondary schools in Ikorodu West Local Government Area, Lagos State.

Table 3: Result of Analysis on Relationship between Implementation of Continuous Professional Development Programmes and Level of Teachers' Job Performance

Variables	N	X	SD	DF	r	p-value	Remark
Implementation of CPD	210	26.55	2.656	208	.376	.000	S
Teachers' Job Performance	210	27.11	3.030				

Note: $P < 0.05$, Source: Field Work

Table 3 shows the relationship between implementation of CPD and teachers' job performance in public secondary schools in Ikorodu West Local Government Area. The result revealed that $r(208) = .376$, $p < 0.05$, indicating a strong positive relationship between the two variables. Since the p-value of 0.000 is less than 0.05 level of significance, the null hypothesis was rejected, it was concluded that there is a significant relationship between implementation of CPD and teachers' job performance in public secondary schools in Ikorodu West Local Government Area, Lagos State.

Discussion of Findings

The findings of this study revealed that teachers in public secondary schools in Ikorodu West Local Government Area, Lagos State, demonstrate a high level of job performance. This may be attributed to sustained engagement in professional development activities and collaborative practices within schools. The implication is that maintaining structured support systems, particularly through Continuous Professional Development (CPD) programs, mentoring, and technology training, could further consolidate and enhance teachers' effectiveness. This aligns with Abreh (2018) who reported that Continuous Professional Development opportunities offered to teachers gave them opportunities to hone down their teaching methodology and has also identified common mistakes students make in examinations and provide remedial actions needed to correct such mistakes.

It was revealed from the study that Continuous Professional Development Programmes in Public Secondary Schools in Ikorodu West Local Government Area, Lagos State is well implemented. The finding of the study is in consonance with Ajetunmobi and Oladejo (2020) who asserted that the implementation of continuous professional development programmes positively enhances teachers' job performance. The author also opined that a robust continuous professional development programs when implemented met the needs of teachers. Thus, teachers need to regularly engage in continuous professional development programmes for them to improve their knowledge of the subject they teach and other areas of their job.

Finally, the findings revealed a significant positive relationship between implementation of Continuous Professional Development Programmes and level of teachers' job performance in Public Secondary Schools in Ikorodu West Local Government Area, Lagos State. This finding of the study is in agreement with Amie-Ogan (2021) who founds a high and positive relationship between Continuous Professional Development Programmes and level of teachers' job performance in Public Secondary Schools. The findings therefore, underscore the importance of continuous investment in teacher capacity-building initiatives to sustain quality education delivery in public secondary schools.

Conclusion

The results of the study revealed that teachers demonstrated high level job performance. Also, it was revealed from the study that Continuous Professional Development Programs in Public Secondary Schools in Ikorodu West Local Government Area, Lagos State is well implemented.

Finally, it can be concluded from the study that continuous professional development had great influence on teachers' job performance in public secondary schools in Ikorodu West Local Government Area, Lagos State.

Recommendations

From the result of the study, it can therefore be recommended that:

- 1) Government should ensure that all teachers in public secondary schools have equal access to continuous professional development programs. Trainings should be scheduled at convenient times to accommodate teachers' work schedules and minimize disruptions to teaching activities.
- 2) Schools should encourage peer mentoring and collaborative learning among teachers. Experienced teachers can mentor the new ones, fostering a culture of continuous improvement and shared knowledge.

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ETHICAL MANAGEMENT OF EMERGING TECHNOLOGIES IN EDUCATIONAL ASSESSMENT: BALANCING INNOVATION WITH INTEGRITY

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Abstract

The integration of emerging technologies, such as artificial intelligence (AI), learning analytics, and biometric systems, has transformed educational assessment by offering unprecedented personalisation, efficiency, and scalability. However, this rapid adoption raises significant ethical concerns regarding consent, bias, privacy, and the validity of automated decision-making. This paper explored the imperative of ethically managing these innovations in educational assessment, focusing on balancing technological progress with academic integrity. The study investigated the Ethical Management of emerging technologies in educational assessment: Balancing innovation with integrity. Drawing on quantitative research involving 103 participants from diverse educational settings, Descriptive statistics, including means and standard deviations, were employed to analyze the collected data. Inferential statistical analyses, such as regression analysis, analysis of Variance (ANOVA), and correlation analysis, were used to test null hypotheses at a significance level of 0.05. The findings revealed that ethical considerations play a significant role in shaping trust in AI assessment tools among educators and students, and also revealed that institutional policies and governance models significantly affect the ethical use of AI in educational assessments. The paper recommended establishing ethics committees, conducting regular algorithmic audits, implementing robust data governance policies, integrating digital ethics training for educators, and fostering participatory design processes to ensure human-centered technology deployment.

Keywords: *Algorithmic Bias, Artificial Intelligence (AI), Educational Assessment, Ethical Management, Institutional Policies*

Introduction

The rapid evolution of the educational landscape has transformed traditional assessment methods through the integration of emerging technologies such as artificial intelligence (AI), biometric systems, and learning analytics. These tools offer unprecedented scalability, efficiency, and personalisation in evaluating student performance, promising deeper insights into learning processes (Rehan, 2023). However, their accelerated adoption raises critical ethical concerns regarding privacy, bias, consent, and the reliability of automated systems (Selwyn et al., 2024).

Global investment in educational technology is projected to surge from \$227 billion in 2020 to \$404 billion by 2025 with significant allocations toward AI-driven analytics and assessment tools (HolonIQ, 2023). This growth underscores the urgent need for robust ethical frameworks to guide their implementation as highlighted by the European Commission (2020) and the OECD Education 2030 program (OECD, 2022). Without clear ethical guidelines, technologies like real-time feedback systems, adaptive testing, and facial analysis for emotional detection risk exacerbating inequalities and eroding trust in assessment systems (Aly, 2024; Buolamwini & Gebru, 2020). Studies reveal algorithmic biases in AI grading systems with facial recognition technologies showing accuracy disparities of 98% for lighter-skinned individuals versus 65% for darker-skinned individuals, raising concerns about fairness and equity (Jamil & Belkacem, 2024).

By synthesizing case studies, policy analyses and recent research, it aims to illuminate strategies that align technological innovation with core educational values of equity and trust. The framework draws on principles such as transparency, human oversight and nondiscrimination from the European Commission's Ethics Guidelines for Trustworthy AI, while acknowledging the need for context-sensitive adaptations to account for regional and institutional variations (Darvishi & Lim, 2022; UNESCO, 2024).

The study provided answers to the following questions

- i. How do specific ethical concerns affect student and educator trust in AI-driven assessment tools?
- ii. What institutional policies and governance models best support ethical use of AI in educational assessments across diverse student populations?
- iii. How does algorithmic assessment impact learning outcomes and fairness for marginalized student groups?
- iv. What trade-offs exist between embedding ethical design principles and maintaining the efficiency of emerging assessment technologies?

Literature Review

Ethical Management

Ethical management in educational technology focuses on the responsible governance of digital systems to uphold accountability, privacy, fairness, and inclusion. Scholars such as Ossiannilsson (2025) and Williamson (2022) argue that as assessment systems become automated and data-driven, institutions must ensure that these technologies serve pedagogical purposes rather than purely commercial or administrative interests. Literature emphasizes that ethical oversight is no longer optional; it is foundational for maintaining trust and protecting student rights. Core principles identified in various studies include transparency, equity, and informed consent (Nguyen et al., 2023; Holmes, 2021; Chassignol, 2022). Transparency entails providing clear information about how AI-powered tools make decisions; equity requires proactive efforts to mitigate algorithmic bias; and informed consent necessitates explicit communication regarding data collection and usage. Global policy guidance, especially from UNESCO (2024), highlights the importance of establishing regulatory frameworks, ethical

review boards, and ongoing digital ethics training. Together, the literature stresses the need for adaptive governance structures that can respond to rapid technological changes while ensuring educational integrity.

Emerging Technologies

Emerging technologies, particularly artificial intelligence (AI), machine learning, and natural language processing, are transforming assessment through methods such as adaptive testing, automated essay scoring, predictive analytics, and real-time feedback (Luckin, 2023; Selwyn, 2022). These innovations promise greater personalisation, multilingual accessibility, and early identification of learning gaps (Feng, 2021). Additionally, blockchain technologies enhance credential security and transparency. However, scholars consistently highlight the ethical risks associated with these innovations. Virginia Eubanks (2020) draws on broader critiques of algorithmic governance to illustrate how predictive systems can perpetuate structural inequities. In educational contexts, issues such as biased datasets, opaque algorithms, and intrusive surveillance practices threaten fairness and student autonomy (Jafari & Zou, 2021; Mahamuni & Tonpe, 2024). A recurring concern is the limited involvement of educators and ethicists in the design of these systems, which often leads to tools prioritizing efficiency over equity. The literature calls for interdisciplinary collaboration and the integration of ethics-by-design approaches to align innovation with inclusivity and accountability.

Educational Assessment

Standardized testing, which frequently gauges memorization rather than creativity or critical thinking, has long been a part of traditional school evaluations (Mahamuni & Tonpe, 2024). This paradigm could be changed by emerging technologies, which enable more formative, real-time, and comprehensive evaluations. To avoid merely digitizing antiquated or biased models, such a change must be driven by ethical standards (Selwyn, 2022; Holmes, 2021; Luckin, 2023).

The impact of technology on trust is among its most important effects on assessment. Students' or teachers' trust in the validity and fairness of assessment outcomes may be damaged if they believe algorithms are punitive, prejudiced or opaque (Williamson, 2022; Tsai, 2023; Veletsianos, 2020). Furthermore, problems like unauthorized data use or data security breaches can compromise academic integrity. Transparent procedures, explainable AI and participatory design including all stakeholders are necessary for establishing trust (Mahamuni & Tonpe, 2024).

According to Vidhyapriya and Arun (2025), the ultimate goal of integrating developing technology into assessment should be to supplement human judgment and educational objectives rather than to replace them. Enhancing access and fairness without adding additional levels of discrimination is what is meant by equitable assessment (Floridi, 2020; Kwet & Prinsloo, 2021; Feng, 2021). Innovations protect student dignity and serve educational goals when they are managed ethically.

Ethics of Care Theory

The study is based on the Ethics of Care Theory developed by Carol Gilligan in 1982. Unlike justice-oriented ethical models that emphasise abstract principles, Gilligan's framework focuses on empathy, relational responsibility, and contextual moral reasoning. In the context of educational assessment, where power imbalances and student vulnerability are significant, this perspective highlights the need to pay attention to marginalized learners and the moral obligation to protect their well-being. The theory aligns with recent calls for human oversight, participatory governance, and ethical audits in AI-based assessment systems (Archambault et al., 2024). By prioritising relationships and responsiveness, it offers a normative foundation for

addressing algorithmic bias, ensuring privacy protections, and incorporating fairness into technological design. Although some critics argue that the Ethics of Care may lack universality or be perceived as gendered (Raghuram, 2021), its sensitivity to context makes it particularly well-suited for governing educational technology, where rigid rule-based ethics may fail to consider lived experiences.

The reviewed literature consistently emphasizes a key point: emerging technologies have the potential to transform educational assessment. However, without strict ethical management, these technologies could deepen existing inequalities and diminish trust. Ethical governance frameworks that focus on transparency, equity, and relational accountability, especially through the perspective of the Ethics of Care, offer a solid foundation for balancing innovation with integrity. By integrating ethical principles into the design, implementation, and oversight of these technologies, institutions can ensure that assessment methods remain centered on human needs, inclusive, and aligned with the core purposes of education.

The following hypotheses guided the paper:

- H0₁:** There is no significant influence of specific ethical concerns on student and educator trust in AI-driven assessment tools.
- H0₂:** There is no significant influence of institutional policies and governance models on the ethical use of AI in educational assessments across diverse student populations.
- H0₃:** There is no significant influence of algorithmic assessment on learning outcomes and fairness for marginalised student groups.
- H0₄:** There is no significant influence of ethical design principles on maintaining the efficiency of emerging assessment technologies.

Methodology

This study employed the quantitative research design to explore the ethical management of emerging technologies in educational assessment, focusing on the relationship between algorithmic assessment systems, institutional policies, ethical considerations, and their impact on efficiency, fairness, and trust. A stratified sampling technique was used to select 103 participants from a total population of 380 stakeholders, which included teachers, students, and administrators from various educational institutions that implement AI-driven assessment tools. The stratification ensured proportional representation of each stakeholder group and enhanced the validity and generalizability of the findings, following the sampling guidelines set forth by Krejcie and Morgan (1970). Data was gathered through a structured questionnaire utilizing a 5-point Likert scale. Content validity was established by developing multiple items for each construct, while reliability was assessed using Cronbach's alpha, with a threshold of 0.70. Descriptive statistics, including means and standard deviations, were employed to analyze the collected data. Inferential statistical analyses, such as regression analysis, Analysis of Variance (ANOVA), and correlation analysis, were utilized to test the study's hypotheses. The results were provided in summary and coefficient tables, offering valuable insights into the ethical integration of artificial intelligence in educational assessment.

Table1: Reliability of Variable

	No of Items	No of Cases	CA (α)
1 Ethical Mgt and Design	5	103	0.946
2 Students Trust	5	103	0.947
3 Institutional Policies	5	103	0.947
4 Learning Outcome	5	103	0.947
5 Algorithmic Assessment	5	103	0.900
6 Efficiency	5	103	0.904

Univariate Analysis of Items on Questionnaire

Descriptive statistics like the mean and standard deviation were used to assess the questionnaire's items. According to the study, acceptance is indicated by a mean score of 3.0 or higher on the Likert 5-point scale. This implies that disqualification was automatic for any score below 3.0. This finding was based on the benchmark established in previous studies (Okpu, 2012). Furthermore, the representativeness of the mean was assessed using the standard deviation; a larger SD denoted a less accurate representation of respondents' thoughts. Frequency tables were used to explain and summarize the results.

Table 2: Descriptive Statistics for the Study Variable

	N	Minimum	Maximum	Mean	Std. Deviation
Ethical Mgt and Design	103	1.00	5.00	3.47	1.40
Students Trust	103	1.00	5.00	3.25	1.51
Institutional Policies	103	1.00	5.00	3.19	1.36
Learning Outcome	103	1.00	4.00	3.46	1.40
Algorithmic Assessment	103	1.00	5.00	3.43	1.48
Efficiency	103	1.00	5.00	3.21	1.40
Valid N (listwise)	103	1.00	5.00		

Source: SPSS Output

Test of Hypotheses

Hypothesis One

H01: There is no significant influence of specific ethical concerns on student and educator trust in AI-driven assessment tools.

Table 3: Model Summary for Ethical Design & Concern and Student's Trust

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.876 ^a	.767	.765	.73020

a. Predictors: (Constant), Ethical Design

The R Square value of 0.767 indicates that 76.7% of the variation in trust between students and educators can be attributed to ethical concerns related to ethical design. This signifies a significant proportion, highlighting that ethical considerations play a major role in determining trust. The adjusted R² value of 0.765 further confirms the robustness of the model, even after accounting for sample size and complexity. The small difference between R² and Adjusted R² suggests that the model is stable and reliable. Additionally, the relatively low standard error of estimate indicates that the model's predictions regarding trust are fairly accurate. Hence, the strong R value and high R² demonstrate a substantial influence of specific ethical concerns on the trust of students and educators in AI-driven assessment tools.

Table 4: ANOVA for Ethical Design & Concern and Student's Trust

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	177.584	1	177.584	333.058	.000 ^b
	Residual	53.853	101	.533		
	Total	231.437	102			

a. Dependent Variable: Students Trust

b. Predictors: (Constant), Ethical Design

F (333.058), P value = 0.000 which is < 0.05 hence shows a strong significant relationship.

Table 5: Coefficients for Ethical Design & Concern and Student’s Trust

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients		
1	(Constant)	-.027	.194		-.142	.887
	Ethical Design	.944	.052	.876	18.250	.000

a. Dependent Variable: Student’s Trust

Source: SPSS Output

The statistical analysis reveals a strong relationship between ethical design and trust in AI-powered educational assessment tools, as evidenced by the Model Summary Table 3, which reports an R value of 0.876 and an R² of 0.767, indicating that ethical design explains approximately 77% of the variance in educators' and students' trust. The ANOVA Table 4 shows a significant model fit with F = 333.058 and p = 0.000 (p < 0.05, tested at α = 0.05), with a mean square of 177.584. The Coefficient Table 5 further supports this, displaying t-values of 0.142 and 18.250 with standard errors of 0.194 and 0.052, respectively, confirming the significance of ethical factors. These results lead to the rejection of the null hypothesis, affirming that ethical considerations significantly influence trust in AI assessment tools among educators and students.

Hypothesis Two

Ho2: There is no significant influence of institutional policies and governance models best support on ethical use of AI in educational assessments across diverse student populations.

Table 6: Model Summary for Institutional Policies and Ethical design

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.873 ^a	.763	.761	.68374

a. Predictors: (Constant), Institutional Policies

The correlation coefficient (R) of 0.873 indicates a strong positive relationship between institutional policies and governance models and the ethical use of AI in educational assessments. This suggests that well-structured institutional policies are closely associated with more ethical AI practices. The R-squared value of 0.763 means that 76.3% of the variation in ethical AI use can be explained by these policies and governance models. This substantial proportion highlights the critical role that institutional frameworks play in ensuring ethical implementation across diverse student populations. The adjusted R-squared of 0.761 shows minimal shrinkage from the R-squared value, indicating that the model is stable and not overly influenced by sample size or complexity. This finding enhances confidence in the predictive power of institutional policies. The standard error of 0.68374 reflects the average deviation of observed values from predicted values. Although this figure is slightly higher than in some other models, it remains within an acceptable range, suggesting reasonable prediction accuracy. Given the strong R value and high R-squared, indicated that institutional policies and governance models significantly influence the ethical use of AI in educational assessments

Table 7: ANOVA for Institutional Policies and Ethical design

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	151.982	1	151.982	325.094	.000 ^b
	Residual	47.218	101	.468		
	Total	199.199	102			

a. Dependent Variable: Ethical Design

b. Predictors: (Constant), Institutional Policies

F (325.094), P value = 0.000 which is < 0.05 hence shows a strong significant relationship.

Source: SPSS Output

Table 8: Coefficients for Institutional Policies and Ethical design

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients		
1	(Constant)	.612	.172		3.550	.001
	Institutional	.898	.050	.873		
	Policies					

a. Dependent Variable: Ethical Design

The statistical analysis demonstrates a significant relationship between institutional policies and the ethical use of AI in educational assessments, as shown in the Model Summary with an R value of 0.873 and an R² of 0.763, indicating that institutional policies account for approximately 76% of the variance in ethical AI application. The ANOVA Table 7 confirms the model’s significance with F = 325.094, p = 0.000 (p < 0.05, tested at α = 0.05), and a mean square of 151.982. The Coefficient Table 8 further supports this, reporting t-values of 3.550 and 18.030 with standard errors of 0.172 and 0.050, respectively, highlighting the predictive strength of institutional norms. These findings lead to the rejection of the null hypothesis, affirming that institutional policies and governance models significantly influence the ethical application of AI in educational assessments across diverse student demographics.

Hypothesis Three

Ho3: There is no significant influence of algorithmic assessment on learning outcomes and fairness for marginalized student groups.

Table 9: Model Summary for Algorithmic Assessment and Learning Outcome

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.931 ^a	.866	.865	.51428

a. Predictors: (Constant), Algorithmic Assessment

R square .866, which is approximated to R² = 0.87. This means the predictor has 87% variance with the dependent variable.

Table 10: ANOVA for Algorithmic Assessment and Learning Outcome

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	173.178	1	173.178	654.782	.000 ^b
	Residual	26.713	101	.264		
	Total	199.890	102			

a. Dependent Variable: Learning Outcome

b. Predictors: (Constant), Algorithmic Assessment

F (654.782), P value = 0.000 which is < 0.05 hence shows a strong significant relationship.

Source: SPSS Output

Table 11: Coefficients for Algorithmic Assessment and Learning Outcome

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients		
1	(Constant)	.442	.128		3.443	.001
	Algorithmic Assessment	.880	.034	.931	25.589	.000

a. Dependent Variable: Learning Outcome

The statistical analysis reveals a strong relationship between algorithmic assessment and learning outcomes, with the Model Summary (Table 9) reporting an R value of 0.931 and an R² of 0.866, indicating that algorithmic assessment accounts for approximately 87% of the variance in learning outcomes. The ANOVA Table 10 confirms the model’s significance with F = 654.782, p = 0.000 (p < 0.05, tested at α = 0.05), and a mean square of 173.178. The Coefficient Table 11 further supports this, showing t-values of 3.443 and 25.589 with standard errors of 0.128 and 0.034, respectively, highlighting the predictive power of algorithmic evaluation. These results lead to the rejection of the null hypothesis, affirming that algorithmic assessment significantly impacts learning outcomes and equity for underrepresented student populations.

Hypothesis Four

Ho4: There is no significant influence of ethical design principles on maintaining the efficiency of emerging assessment technologies.

Table 12: Model Summary for Ethical Design and Efficiency for Assessment Technologies

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.859 ^a	.737	.735	.72363

a. Predictors: (Constant), Ethical Design

R square .737 which is approximated to R² = 0.74. This means the predictor has 74% variance with the dependent variable.

Table 13: ANOVA for Ethical Design and Efficiency for Assessment Technologies

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	148.452	1	148.452	283.497	.000 ^b
	Residual	52.888	101	.524		
	Total	201.341	102			

a. Dependent Variable: Efficiency

b. Predictors: (Constant), Ethical Design

F (283.497), P value = 0.000 which is < 0.05 hence shows a strong significant relationship.

Source: SPSS Output

Table 14: Coefficients for Ethical Design and Efficiency for Assessment Technologies

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients		
1	(Constant)	.232	.192		1.210	.229
	Ethical Design	.863	.051	.859	16.837	.000

a. Dependent Variable: Efficiency

The statistical analysis indicates a significant relationship between ethical design principles and the efficiency of evaluation technology, as shown in the Model Summary (Table 12) with an R value of 0.859 and an R^2 of 0.737, suggesting that ethical design accounts for approximately 74% of the variance in evaluation technology efficiency. The ANOVA Table 13 confirms the model's significance with $F = 283.497$, $p = 0.000$ ($p < 0.05$, tested at $\alpha = 0.05$), and a mean square of 148.452. The Coefficient Table 14 further supports this, reporting t-values of 1.210 and 16.837 with standard errors of 0.192 and 0.051, respectively, underscoring the predictive strength of ethical design. These findings lead to the rejection of the null hypothesis, affirming that ethical design principles significantly enhance the effectiveness of emerging evaluation tools.

Discussion of Findings

The study investigated ethical management of emerging technologies in educational Assessment: balancing innovation with integrity

Ethical Considerations and Trust in AI Assessment Tools

The findings indicated that ethical considerations play a significant role in shaping trust in AI assessment tools among educators and students. This aligns with Alipasa (2026), who reported that perceptions of fairness, transparency, and human oversight influence stakeholders' confidence in AI-based assessments. Students expressed caution in trusting AI-generated scores when transparency and fairness were lacking, while faculty members exhibited higher trust when ethical safeguards were evident. The study revealed that institutional policies and governance models significantly affect the ethical use of AI in educational assessments. This conclusion is consistent with the work of Patel, Lim, and Clarke (2025), who emphasized that governance structures incorporating ethical oversight and transparent auditing enhance compliance and stakeholder trust in educational AI systems.

The finding also showed that governance models impact the ethical application of AI across diverse student populations supports the results of Patel et al. (2025). Their research indicates that governance frameworks focused on fairness and inclusivity can reduce ethical risks and promote equitable AI use. Case studies demonstrated measurable improvements in compliance and trust where responsible governance models were implemented.

The study further identified that algorithmic assessment significantly affects learning outcomes and equity for underrepresented populations. These findings align with those of Chávez Urbina et al. (2025), who highlighted algorithmic bias and fairness as critical ethical concerns in AI-based evaluation tools.

Finally, the findings showed that ethical design principles enhance the effectiveness of emerging evaluation tools. This is consistent with the findings of Chávez Urbina et al. (2025), who reported that incorporating transparency, fairness testing, and stakeholder consultation into AI assessment design improves accountability and reliability. However, building on prior research, such as Sain et al. (2024), Azer and Samir (2024), Agatha and Abdulmutallib (2025), which emphasized balancing AI's operational benefits with ethical responsibilities, this study provides robust empirical evidence through rigorous hypothesis testing, validating the strong predictive link between institutional ethical policies and tangible outcomes in educational technology use. By addressing the abstraction critiques of Azer and Samir (2024) and extending beyond the media literacy focus of Huda and Hashim (2022), this research offers a targeted, data-driven framework for ethical management, shifting from theoretical advocacy to practical, empirically supported strategies for institutions to implement, ensuring fairness, trust, and system effectiveness in AI-driven educational assessments.

Conclusion

The study on the ethical management of emerging technologies in educational assessment reveals that achieving a balance between innovation and integrity is crucial for fostering trust, justice, and equity in educational systems. It demonstrates that algorithmic assessments significantly enhance learning outcomes and fairness, particularly for marginalized groups, while institutional policies are vital for ensuring ethical AI application across diverse student populations. Ethical design principles strongly influence educator and student trust in AI-driven assessment tools, with their integration also improving technological efficiency, highlighting the intrinsic link between ethical oversight and technical progress. Grounded in the Ethics of Care Theory, the study emphasizes relational and context-sensitive approaches to safeguard learner well-being and uphold core educational values. By addressing ethical challenges such as bias, transparency, and data privacy through robust frameworks, the study shows how assessment technologies can foster inclusive and equitable learning environments, supported by strong statistical evidence linking ethical design to enhanced trust, justice, and efficiency.

Recommendations

The study recommended the following:

1. Establish dedicated ethics committees within educational institutions to oversee the selection, deployment, and ongoing evaluation of AI assessment technologies by ensuring alignment with principles of transparency, fairness, and inclusivity.
2. Integrate digital ethics training into professional development programs for educators to enhance their ability to critically engage with AI tools and advocate for ethical practices.
3. Foster international collaboration among stakeholders to develop adaptable ethical guidelines that respect local cultural and institutional contexts, addressing global disparities in technology adoption.
4. Engage students, educators, and ethicists in participatory design processes to ensure that assessment technologies are human-centered and aligned with the core educational values of equity and integrity.

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ETHICAL CONSIDERATIONS IN THE MANAGEMENT OF DIGITAL LITERACY FOR SUSTAINABLE NATIONAL DEVELOPMENT: A CASE STUDY OF TERTIARY INSTITUTIONS IN CROSS RIVER STATE

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Abstract

The pursuit of ethical consideration in management of digital literacy is vital to fostering individual growth, institutional and societal progress, and global development. This paper assessed the role of ethical consideration in management of digital literacy for sustainable development in tertiary institutions. This study was conducted in 3 selected tertiary institutions in Cross River State, Nigeria. A mixed research approach and a convergent parallel design were used. One hundred and ten (110) respondents comprising 10 departmental heads and 100 students were involved. Data were collected through structured questionnaires for students and semi-structured interviews for departmental heads. Quantitative data were analysed using descriptive statistics of means and standard deviation, frequencies and percentages while qualitative data were analysed thematically. The findings indicate that digital literacy improves economic preparedness and national digital transformation, which contributes to optimising national development. The study concluded that ethical consideration in management of digital literacy is paramount in integrating digital curricula and fostering civic engagement and environmental awareness. It was recommended among others that government should ensure that digital tools are provided for the utilization of both lecturers, administrators and students.

Keywords: *Ethical considerations, Management, digital literacy, National Development*

Introduction

Digital literacy in education refers to the ability to use technology such as computers, smart phones and the internet in a safe and smart way, to learn, create and share information. It includes technical skills, critical thinking and ethical considerations. Ethical considerations are guiding principles that help in the decision of what is right or wrong most especially when these actions affect others. In the context of ethical considerations in digital literacy or technology usage, issues such as plagiarism avoidance, honesty when sharing information, avoidance of cyber bullying or spreading false information, respecting people's privacy online, giving credit to sources of information and so on, should be considered and taught.

In today's digital age, the ethical management of digital literacy is increasingly vital for sustainable national development, particularly in tertiary education. Countries worldwide recognize that equipping students with digital skills is essential for fostering economic growth, social inclusion, and environmental sustainability. However, incorporating digital technologies into educational systems poses ethical challenges, such as data privacy, equitable access, and responsible usage (Mtawa, 2023). How schools manage these ethical issues, like ensuring data privacy, promoting fair technology access, and encouraging responsible usage, directly affects education's capacity to support broader developmental goals, such as creating a skilled workforce, informed citizens, and an inclusive digital economy. Neglecting ethical practices can inadvertently exacerbate inequalities, violate student rights, and undermine trust, ultimately impeding progress toward sustainable national development. Conversely, ethically managed digital literacy ensures that technology in education is used safely, fairly, and effectively, maximizing its developmental benefits.

In the United States, initiatives like Connected aim to improve internet connectivity and technology integration in public schools, fostering equitable access to digital resources. However, these initiatives also raise concerns regarding data Protection of personal data and the responsible, ethical deployment of technology within educational environments (U.S. Department of Education, 2014). Similarly, England has recognized the need to reform its secondary school curriculum to close gaps in digital literacy education. A review by Oxford, Cambridge, and RSA Examinations (OCR) highlighted the importance of reinstating digital literacy, ethical social media use, and artificial intelligence education to prepare students for the modern digital landscape (OCR, 2023).

In Asia, countries such as China have developed comprehensive strategies to bolster digital literacy among both teachers and students. The Chinese Ministry of Education's Teacher Digital Literacy Industry Standard establishes a framework for digital awareness, technology skills, and professional development, aiming for the ethical and effective use of digital tools in education (Ministry of Education of the People's Republic of China, 2022). In Southeast Asia, rapid digitalisation has posed challenges to existing educational practices. UNESCO reports stress the necessity for equitable access to technology, appropriate governance, and adequate teacher training to fully leverage the benefits of digital education while addressing ethical concerns like data privacy and online safety (UNESCO, 2023).

In South Africa, the integration of digital literacy into education faces obstacles related to infrastructure and teacher training. Addressing ethical considerations in digital education is crucial for promoting inclusive and sustainable development (Department of Basic Education, South Africa, 2021). In Tanzania, the incorporation of digital literacy in secondary education is still developing. Studies indicate a lack of classroom support for students' digital literacy skills, primarily due to teachers' unpreparedness and inadequate training. This gap highlights the importance of ethical management practices to ensure that digital literacy initiatives positively contribute to sustainable national development (Patobas, Machumu, & Mtawa, 2023). In light of these global and local contexts, this study aims to investigate how ethical considerations in managing digital literacy in tertiary institutions in Cross River State influence sustainable national development. By examining best practices and challenges, the research seeks to provide insights that can inform policy and practice, ensuring that digital literacy acts as a catalyst for equitable and sustainable progress.

Statement of the Problem

To effectively support sustainable national development, the integration of digital literacy in tertiary institutions must be managed with ethical considerations. This ethical management is crucial for ensuring that students not only acquire digital skills but also embrace values such as responsible internet usage, data privacy, and equitable access to technology. Such an

approach would help cultivate a generation that is both digitally competent and ethically aware, able to stimulate innovation, enhance economic development, and advance social inclusion among students. However, the current landscape reveals significant shortcomings. Many institutions are confronted with challenges, including insufficient teacher training in digital ethics, disparities in access to ICT infrastructure, and a lack of clear guidelines for the safe and responsible use of digital tools. As a result, students may misuse digital platforms, encounter privacy risks, or fall behind due to unequal access to technology. These challenges risk exacerbating the digital divide and diminishing the potential of education to contribute to sustainable national development. There is an urgent need for our tertiary education system to establish and enforce ethical standards within digital literacy programmes. This includes providing training on digital ethics, ensuring equitable access to digital resources, and incorporating ethical considerations into the curriculum. By taking these steps, we can ensure that the digital transformation of education is both meaningful and responsible, effectively advancing national development objectives.

Objectives of the Study

- i. To assess the role of digital literacy integration and access on promoting national sustainable development in higher institutions.
- ii. To examine the influence of data privacy practises of digital literacy in promoting national sustainable development in higher institutions.

Research Questions

- i. How does digital integration and access influence national sustainable development in higher institution.
- ii. To what extent does data privacy practices influence national sustainable development in higher institution.

Literature Review

Digital Literacy Integration and Access on Sustainable National Sustainable Development in Higher Institutions

The integration of digital skills into tertiary education curricula by the National Universities Commission (NUC) has proven to be both relevant and impactful in shaping students' capacity for sustainable national development. The transformative role of digital literacy to the economy in a fast-evolving world cannot be overemphasised (Asaju and Ashepo, 2025). Biala, et., 2025). From transforming the operation of higher education institutions to advancing knowledge and information literacy (Odularu and Bokwe, 2025), digital literacy has become a crucial aspect of life and living (Moruf et al., 2025). Studies have been carried out on the significant role of digital literacy in the outcome of undergraduate performance Aremu and Udofia, 2025, and digital literacy integration in tertiary education (Ajibade and Aliyu, 2025). Ezeugwu, (2025) explored the impact of digital transformation on sustainable development in Nigerian higher education institutions (HEIs), with a focus on the moderating role of organisational culture. Findings showed that digital transformation works best when schools have a culture that is open to change, which helps make them more sustainable. In practice, this means schools should create policies that support a digital-friendly environment while also finding ways to overcome challenges in using technology.

Additionally, Onyem and Chukwu (2023) examined the impact of digital literacy on sustainable development in Nigeria. Their study revealed that inadequate infrastructure and funding hinder the effective implementation of digital literacy programmes, emphasising the need for government and private sector collaboration to address these challenges. In Nigeria, Obasi and Adieme (2023) explored the management of digitalization in secondary education

for sustainable development in Imo State. Their study found that effective management of digital learning facilities by school principals significantly influences the integration of technology into teaching and learning processes, which is crucial for achieving sustainable development goals.

In the United States, integrating digital literacy into education has been pivotal for sustainable development. Baek et al. (2023) developed an integrated curriculum combining environmental literacy, data literacy, and computer science to empower underrepresented students. Their pilot study demonstrated that students could effectively use technology to address real-world environmental issues, highlighting the importance of digital literacy in fostering civic engagement and sustainable development. The "Take a Giant Step" report by the Digital Age Teacher Preparation Council proposes a comprehensive strategy to integrate digital media in education, emphasizing the importance of skilled teachers in effectively utilising digital tools to foster learning among children. The report highlights the need for advancing technology infrastructure and modernizing professional learning for teachers and parents to ensure equitable access to 21st-century skills and technology, particularly for underserved students.

In the UK, the Oxford, Cambridge and RSA Examinations (OCR) review identified significant gaps in the secondary school curriculum, particularly concerning digital literacy and climate change education. The report recommends reinstating digital literacy, emphasising the need for education about the ethical use of social media and artificial intelligence. It also suggests the creation of an independent body to maintain a contemporary curriculum that reflects the diversity of modern Britain. Additionally, the UK government has implemented initiatives to enhance digital literacy among students. For example, the Department for Education has launched programs to integrate computing and digital skills into the national curriculum, aiming to equip students with the necessary competencies for the digital economy. In China, Yang et al. (2024) developed and validated a digital learning competence scale for secondary vocational school students. Their study emphasizes the importance of digital competencies in enhancing students' learning experiences and preparing them for the digital economy, thereby contributing to sustainable national development.

Furthermore, Zheng (2023) explored the digital literacy of Chinese secondary school teachers in the era of artificial intelligence. The study highlights the need for teacher training programs to enhance digital competencies, ensuring that educators can effectively integrate technology into their teaching practices. In Kenya, a study by Chourio-Acevedo et al. (2025) highlighted the challenges and opportunities in integrating digital literacy into education. The research emphasized the role of libraries and community centers in providing digital literacy programs, which have been instrumental in empowering rural populations, particularly women, thereby contributing to sustainable development.

Kerkhoff and Makubuya (2022) conducted a case study on professional development programs aimed at enhancing digital literacy among educators in rural Kenya. Their findings underscore the importance of culturally relevant training programs that incorporate local values and learning styles to effectively integrate ICT into the curriculum. In Tanzania, Mandari and Mwemezi (2025) investigated the digital literacy skills of public sector employees and their impact on achieving a sustainable digital economy. The study revealed that employees with tertiary education and regular internet access demonstrated significantly higher proficiency in advanced digital skills, underscoring the importance of digital literacy in national development. Additionally, Mfaume and Bilinga (2024) explored the promotion of cyber ethics compliance among teachers in Tanzania. Their study emphasises the need for training on the pedagogical uses of technology and the development of policies for responsible technology use in schools, highlighting the ethical considerations in digital literacy management.

Data Privacy Practices and Management on National Sustainable Development in Higher Institution

The United States showed a rapid shift to online learning during the COVID-19 pandemic which exposed significant gaps in data privacy practices within secondary schools. Utter et al. (2021) surveyed parents and found that while 80.7% of children used school-issued devices, only 55.7% of parents strongly agreed that schools protected student digital privacy. Notably, 35.4% of parents were uncertain about their school's digital policies, underscoring a lack of transparency and communication. Furthermore, the use of student-monitoring software like GoGuardian and Gaggle has raised concerns about over-surveillance and potential misuse of student data. These tools, initially implemented to ensure student safety, have been criticized for disproportionately affecting low-income students and potentially infringing on students' rights to privacy and freedom of expression.

A study by Defend Digital Me (2020) in the United Kingdom revealed that over 65% of schools did not inform students or parents about personal data shared with third parties when using educational apps. Additionally, only 17% of schools conducted regular data audits, indicating a lack of oversight in data management practices. The report emphasized the need for improved competence and capacity across the education sector to ensure staff understand the digital environment, data management, and children's rights. In China, the integration of artificial intelligence in education has raised ethical concerns regarding data privacy. Squirrel AI, an innovative education company, uses AI to provide personalized tutoring by collecting extensive data on student performance. While this approach aims to enhance learning outcomes, it also poses risks related to surveillance and the potential misuse of student data.

In Kenya, the Communications Authority published the 2022 Industry Guidelines for Child Online Protection and Safety, mandating schools to adhere to data protection measures, including safeguarding against cyberbullying and ensuring the ethical use of student data. Furthermore, the Kenya ICT Action Network (KICTANet) highlighted challenges faced by youth regarding data privacy, such as lack of awareness about privacy settings and the implications of sharing personal information online. The organization emphasizes the need for capacity building to empower youth in understanding and exercising their data protection rights. While specific studies on data privacy practices in secondary schools are limited in Tanzania, the increasing integration of digital tools in education necessitates attention to data protection. Mfaume and Bilinga (2024) emphasized the importance of promoting cyber ethics among teachers, advocating for training on responsible technology use and the development of policies to ensure ethical digital practices in schools.

In Nigeria, the Data Knowledge Information Privacy Protection Initiative (DKIPPI) has been proactive in educating secondary students on data protection. Through competitions and workshops, students are sensitized to handle personal data responsibly, emphasizing the importance of data privacy in the digital age. Akinloye (2023) posits that protection of data in Nigeria has been a significant area of concern and case studies of data protection violations have revealed an overall trend of violation of regulations that govern privacy and protection of data in private schools. Additionally, the National Information Technology Development Agency (NITDA) launched the Digital States Initiative to train youths in digital literacy and skills, aiming to enhance the nation's digital economy and promote data protection awareness.

Methodology

The study adopted the mixed methods research design combining both quantitative and qualitative approaches. A convergent parallel design was adopted for the study. The study targeted total population of one hundred and ten (110) respondents comprising 10 departmental heads who were selected purposively and 100 students selected using stratified random sampling. Data collection was conducted through questionnaires administered to students and

interview guides with departmental heads. Quantitative data from questionnaires were analysed using descriptive statistics (means, frequencies, percentages) and Qualitative data from interviews was transcribed and subjected to thematic analysis to identify key themes and patterns. The ethical guidelines were followed with the informed consent, confidentiality and voluntary participation was maintained.

Results

- i. **Research question 1:** To what extent does digital literacy integration access on national sustainable development in higher institution.
- iii. Table 1 shows to what extent does not influence national sustainable development in higher institution.

S/N	Items	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	S.D	Decision
1	I use digital tools provided in school for personal study	0(0%)	20(20%)	70(70%)	10(10%)	2.10	.541	Disagree
2	Digital skill programs in school prepares me to contribute to national development	20(20%)	75(75%)	5(5%)	0(0%)	3.20	.402	Strongly Agree
3	Lecturers have access to digital tools for teaching	18(18%)	52(52%)	16(16.0%)	14(14%)	2.70	.461	Agree
4	Digital infrastructure (internet, computers) is available in my school	10(10%)	30(30%)	46(46%)	14(14%)	2.40	.492	Agree
5	My curriculum links digital skills with sustainable development goals	22(22%)	38(38%)	34(34%)	6(6%)	2.60	.492	Agree
6	I am confident using digital tools	16(16%)	34(34%)	45(45.%)	5(5%)	2.50	.503	Agree
7	Digital literacy increases my future career success	80(80%)	20(20%)	0(0%)	0(0%)	3.80	.402	Strongly Agree
8	The digital skills taught are relevant to current job market demands	11(0%)	49(49%)	35(35%)	5(5%)	2.60	.492	Agree
9	There's fair access to digital resources (internet, computers) and opportunities in school	0(0%)	5(5%)	53(53%)	42(42%)	1.50	.503	Strongly Disagree

10	Digital learning overcomes limitations and disabilities	20(20%)	50(50%)	26(26%)	4(4%)	2.90	.704	Agree
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Integration of Digital Skills and Access in the Management of National Sustainable Development in Higher Institution.

Findings in Table 1: shows that respondents strongly agreed to items 2 and 7, and they agreed to items 3, 4, 5, 6, 8 and 10 as showing students' equitable access to digital tools and its influence on national sustainable development in higher institutions as their mean scores were above 2.50 which is the criterion mean. However, students disagreed with items 1 and 9 detailing that access to digital tools is somewhat limited. Students feel that infrastructure challenges still hinder full participation in digital learning.

The curriculum links digital skills with sustainable development goals item scored a mean of 2.60, showing a strong perception that the curriculum is aligned with sustainable development goals and encourages awareness of global issues. Items such as: I am confident using digital tools, with a mean score of 2.50 suggests that students are fairly confident in using digital technologies, though some may still require support to enhance their digital competence. However, many students agree that digital learning contributes to national development and overcomes limitations and disabilities.

Research Question 2: How does data privacy practices influence management of national sustainable development in higher institutions?

Table 2 shows how data privacy and practices influence management of national sustainable development in higher institutions?

S/N	Items	Strongly Agree	Agree	Dis agree	Strongly Disagree	Mean	SD	Decision
1	ICT programme explains its policies on student's data usage clearly	4(4%)	26(26%)	50(50%)	20(20%)	2.10	.704	Disagree
2	I have received enough training on protecting my personal data online at school	3(3%)	7(7%)	50(50%)	40(40%)	1.60	.492	Strongly disagree
3	I am confident in using privacy settings on school-related platform	0(0%)	50(50%)	48(48%)	2(2%)	2.50	.503	Agree
4	My school communicates well about digital privacy	(2%)	48(48%)	45(45%)	5(5%)	2.50	.503	Agree

	and protection practices							
5	My lecturers are well-trained in protecting students' data	10(10%)	60(60%)	25(25%)	5(5%)	2.70	.461	Agree
6	I am aware of who has access to my online learning data	5(5%)	55(55%)	40(10%)	(0%)	2.60	.492	Agree
7	My right to digital privacy is respected at school	22(22.0%)	58(58%)	23(23%)	7(7%)	2.70	.461	Agree
8	I trust that my personal information is handled responsibly on the school's digital platforms.	30(30%)	50(50.0%)	19(19.0%)	1(1%)	3.10	.704	Strongly Agree
9	My school offers programs or events that teach online safety and data ethics	3(3%)	17(17%)	50(50%)	30(30%)	1.90	.704	Disagree
10	Data protection is important in my digital literacy education	30(30.0%)	60(60%)	10(10%)	0(0%)	3.20	.603	Strongly Agree

Findings in Table 2: show that respondents strongly agree to items 8 and 10, and they agree to items 3, 4, 5, 6, and 7 as showing awareness on digital privacy and data protection as their mean scores were equal to or above 2.50 which is the criterion mean. However, students disagreed with items 1, 2 and 9 indicating that tertiary institutions might not be comprehensive or consistent in covering such topics; policies on student's data usage may not be communicated clearly and there is still a noticeable gap in structured instruction on digital data protection.

Qualitative Analysis

Integration of Digital Skills and Access on Management of National Sustainable Development in Higher Institutions

Students clearly understand that digital skills are important for their administrative effectiveness. They believe that learning digital literacy gives them the tools they need for career growth and to engage with global issues. School administrators might see this as a good starting point to make the curriculum more practical by focusing on real-life problem-solving,

sustainability, and digital innovation. They may also want to highlight how digital learning connects to new job opportunities, so that students find it more useful and motivating.

Many students, however, mentioned that they face difficulties in getting access to digital tools and resources, which makes it hard to fully benefit from digital learning. Although they are eager to learn, problems like not having enough computers, poor internet, or outdated software limit their participation. This shows administrators the importance of investing more in ICT facilities. Suggested solutions include supplying more digital devices, improving internet access, and allowing students to use digital tools even outside classroom hours. These steps would help give every student equal opportunity, no matter their background.

Another common point from the students' and administrators feedback was the helpful role of instructors in building digital literacy. Most students felt supported and guided by their teachers when using digital tools, even though some were not fully confident in their own skills. Administrators might address this by offering ongoing training for teachers on digital teaching methods and technology use in the classroom. By supporting instructors, schools can strengthen students' confidence and improve the quality and consistency of digital learning across different subjects and institutions.

Awareness on Digital Privacy practices

Students demonstrated moderate awareness of digital privacy and data protection, reflecting schools' efforts to address these issues, though depth of understanding remains limited. While learners acknowledge the importance of safeguarding personal information, the guidance provided is often perceived as inconsistent. Administrators may therefore consider embedding structured and practical privacy education within ICT or life skills curricula, emphasizing account security, responsible data sharing, and online safety.

Overall, students expressed trust in their schools' handling of digital safety and privacy, noting the existence of relevant policies. However, clearer communication and stronger enforcement are needed. Strengthening policy frameworks, enhancing system security, and fostering open dialogue with students and parents could improve institutional approaches to digital rights and responsibilities.

Lastly, students demonstrated a strong personal interest in maintaining digital safety and expressed confidence in managing their privacy settings and protecting their information online. This suggests that students are ready to take ownership of their digital behavior. Administrators could build on this readiness by encouraging peer-led digital safety initiatives, such as awareness campaigns or student ambassador programs. Such initiatives would not only enhance the learning environment but also promote a school culture where digital responsibility and privacy are upheld by both students and educators.

Discussion of Findings

The integration of digital skills into tertiary education curricula by the National Universities Commission (NUC) has proven to be both relevant and impactful in shaping students' capacity for sustainable national development. Findings from the questionnaire indicated that students strongly agree that digital literacy enhances future career success and prepared them to participate in society. These local results mirror findings from Baek et al. (2023), who observed that U.S. students in interdisciplinary programs linking digital tools with environmental topics showed increased civic awareness and technological fluency. The high agreement in the current study supports the claim that effective digital literacy can transcend classroom learning and contribute meaningfully to sustainable development goals.

Equitable access to digital resources is central to successful implementation. However, in this study, students reported low access to digital infrastructure, reflecting ongoing limitations. Despite this, instructors were perceived as generally prepared to integrate technology, a sign of positive teacher involvement. These findings support the "Take a Giant Step" report, which stresses that infrastructure and teacher training must go hand-in-hand to ensure inclusive and equitable digital literacy development. Investment in teacher professional development and infrastructural capacity is therefore a foundational step toward achieving national development targets.

Further, the curriculum's integration with sustainable development issues received strong approval, indicating that students are being taught digital content in connection with broader societal goals. This aligns with Kerkhoff and Makubuya (2022), who found that contextualized teacher training enhances ICT integration, especially in rural and diverse settings. The current findings reinforce the idea that culturally relevant pedagogy plays a key role in improving digital skills delivery and sustainability education.

Data privacy emerged as a key area of concern and opportunity in digital literacy development. Results show that students value data protection as an essential part of their education, and are not very aware of digital policies. However, there remains a need for more structured and consistent training, however, students agree to being confident in using privacy settings. These findings are consistent with Utter et al. (2021), who reported a gap in communication between schools and stakeholders regarding data usage policies, leading to low trust and awareness.

Conclusion

The findings of this study clearly demonstrated that effective digital literacy management in tertiary institutions plays a pivotal role in fostering sustainable national development. Students acknowledged the importance of digital skills in enhancing career readiness, civic participation, and environmental responsibility. These outcomes, supported by both local data and global literature, show that when digital literacy is well-integrated into curricula and supported by trained educators and adequate infrastructure, it equips learners with competencies necessary for the 21st-century workforce and national transformation.

However, the study also revealed that while awareness of digital privacy and data protection is growing, there are still gaps in training, system transparency, and ethical data use. Without clear privacy policies, consistent teacher training, and community-based awareness programs, students remain vulnerable to misuse of their digital data. Addressing these gaps is critical to ensuring that digital literacy is not only about technical skills but also about responsible and ethical digital citizenship.

Fully leverage digital literacy for national development, educational stakeholders must prioritize curriculum reform, contextual teacher development, infrastructure investment, and robust data protection strategies. A balanced approach that integrates both technical and ethical dimensions of digital education will empower the next generation to thrive in a digital and sustainable future.

Recommendations

The study recommended that:

1. Government should ensure that digital tools are provided for effective utilization by both students and school administrators.
2. Digital tools should be accessible for students' usages and maintenance culture should be highly encouraged for the protection and sustainability of the tools.

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HARNESSING DIGITAL EDUCATION FOR TRANSFORMATION TOWARDS SUSTAINABLE DEVELOPMENT

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Abstract

Digital education has emerged as a powerful catalyst for transformation and a critical driver of sustainable development. It offers innovative approaches to enhance learning experiences, expand access, and promote lifelong learning across diverse populations. By integrating technology into teaching and learning, digital education can bridge geographical barriers, reduce costs, and foster inclusivity for marginalized groups. It also supports environmental sustainability by reducing reliance on physical resources and lowering the carbon footprint associated with traditional education. Moreover, it equips learners with critical 21st-century skills—such as creativity, adaptability, and problem-solving—that are vital for addressing complex global challenges. However, realizing its full potential requires addressing persistent issues including the digital divide, infrastructural deficits, data privacy concerns, and inadequate teacher preparedness. This paper examines the transformative potential of digital education, explores its role in advancing sustainable development, and presents strategies for policymakers, educators, and technology stakeholders to leverage it effectively for equitable, resilient, and future-ready education systems.

Keywords: *Digital Education, Sustainable Development, Educational Equity, Technology-Enhanced Learning, Transformation*

Introduction

Education is universally recognised as a cornerstone for societal transformation, economic growth, and human development (UNESCO, 2020). In the 21st century, advances in information and communication technologies (ICTs) have redefined how knowledge is created, accessed, and shared (Bates, 2019). Digital education - encompassing online platforms, mobile applications, virtual classrooms, and emerging technologies such as artificial intelligence (AI) and virtual reality (VR) has become integral to the evolution of educational systems. Unlike traditional models limited by physical infrastructure and fixed schedules, digital education offers flexibility, scalability, and inclusivity, enabling learning to occur anytime and anywhere (Anderson & Rivera, 2021).

The relevance of digital education is particularly pronounced in the context of sustainable development. The United Nations' Sustainable Development Goals (SDGs) identify education as central to achieving economic inclusion, environmental protection, and social equity (UNESCO, 2020). Digital platforms extend educational opportunities to marginalized populations, reduce inequalities, and support lifelong learning (Al-Hunaiyyan, Al-Sharhan, & Alhajri, 2018). By reducing the need for printed materials, minimising commuting, and optimizing resource use, digital education also contributes to environmental sustainability (Selwyn, 2020; Govindarajan & Srivastava, 2022).

Furthermore, digital education nurtures skills essential for the modern workforce, including critical thinking, creativity, problem-solving, and digital literacy (Voogt & Roblin, 2012). These competencies enable individuals to address global challenges and adapt to evolving socio-economic conditions. Nevertheless, digital education's potential is hindered by persistent barriers such as limited infrastructure, affordability issues, data security concerns, and inadequate pedagogical readiness (Van Dijk, 2020; Akinyemi & Ofem, 2021). This paper discusses how digital education can be harnessed for transformation toward sustainable development by examining its benefits, challenges, and the strategic measures necessary for its effective implementation.

Concept Of Digitalisation

Digitalization has been defined in various ways by different scholars. Ogunode and Ndayebom (2023) describe *digitisation* as the use of electronic platforms to convert teaching and learning into digital forms such as online courses, assessments, and web-based seminars or workshops. Digitalisation, therefore, refers to the process of transforming physical educational resources into digital formats that can be stored, manipulated, and deployed through computer systems for implementing teaching and learning programs in schools. According to Bejinaru (2019), digitalisation involves converting various forms of content-text, audio, images, and video-into digital formats using technologies such as laptops, the internet, mobile devices, scanners, digital cameras, projectors, and printers. These digital formats can then be processed and accessed via computers.

Machekhina (2017), Ding (2020), and Key (2020) expand this view by including digital platforms such as Zoom, WhatsApp, Google Meet, Skype, Microsoft Teams, and FaceTime, which support synchronous and asynchronous learning. In the educational context, digitalization represents a shift from traditional, physical modes of instruction to virtual and technology-mediated formats. Adegboyega, Asemota, and Edinoh (2025) differentiate *digitization* as the conversion of analog or physical materials into electronic forms, excluding content that was digitally created from inception. They further emphasize that digitalization in education entails a wide range of approaches to transition from conventional pedagogical methods to virtual platforms. Ding (2000) highlights several advantages of digitization: reduced need for physical infrastructure, improved information sharing, reduced redundancy,

and cost-effectiveness. Digital resources can be transmitted, retrieved, and stored with ease, enhancing institutional efficiency and learner access.

Digitization is the process of converting the content of physical media (e.g., periodical articles, books, manuscripts, cards, photographs, vinyl disks, among others) to digital formats (Ananolous). Digitization refers to the process of translating a piece of information such as a book, journal articles, sound recordings, pictures, audio tapes or videos recordings. into bits. Bits are the fundamental units of information in a computer system. Converting information into these binary digits is called digitization, which can be achieved through a variety of existing technologies. A digital image, in turn, is composed of a set of pixels (picture elements), arranged according to a pre-defined ratio of columns and rows. An image file can be managed as a regular computer file and can be retrieved, printed and modified using appropriate software. Further, textual images can be OCRed so as to make its contents searchable.

Digital education plays a pivotal role in advancing transformation and sustainable development, offering a range of benefits that extend beyond access to knowledge. When effectively implemented, it enhances inclusivity, improves pedagogy, reduces environmental burdens, and builds competencies required for future workforces. These benefits are outlined below.

Benefits Of Digital Education

(i) Digital Education and Access to Learning

One of the most significant benefits of digital education is its ability to expand access to quality learning opportunities. Anderson and Rivera (2021) argue that digital platforms effectively break down geographical barriers, allowing learners from rural, remote, and underserved regions to access educational content without the need to relocate to urban centers. This inclusivity is crucial in contexts where higher education institutions and skilled instructors are unevenly distributed. Furthermore, digital education offers flexibility that accommodates learners with diverse life responsibilities. Al-Hunaiyyan et al. (2018) note that online and blended systems enable working professionals, women with caregiving duties, and individuals with disabilities to pursue learning at their own pace and schedule. By reducing structural barriers and democratising access, digital education serves as a powerful tool for equity and inclusion in the pursuit of sustainable educational development.

(ii) Pedagogical Innovation and Engagement

Digital technologies provide avenues for pedagogical innovation, enabling teaching and learning strategies that enhance student engagement and improve learning outcomes. Bates (2019) explains that the use of multimedia resources, interactive simulations, and adaptive learning platforms facilitates deeper cognitive processing, thereby improving knowledge retention. The flexibility of digital tools also supports constructivist pedagogies, where learners actively build knowledge through problem-solving and inquiry-based activities. Siemens (2014) highlights that digital education allows for personalized learning pathways, whereby learners progress based on mastery of content rather than seat time. Such personalisation fosters learner autonomy, motivation, and differentiated instruction, which are essential for cultivating higher-order thinking skills. The integration of digital platforms also enables immediate feedback and data-driven assessment, ensuring that educators can continuously refine teaching practices to meet the diverse needs of learners.

(iii) Environmental Sustainability Benefits

Digital education contributes directly to environmental sustainability, aligning with global goals for responsible consumption and production. Selwyn (2020) emphasizes that transitioning to online delivery reduces reliance on printed learning materials,

thereby minimizing paper waste and deforestation pressures. Furthermore, digital education reduces the need for daily commuting, resulting in significant reductions in carbon emissions associated with transportation. Institutions adopting digital platforms can also minimize investments in large-scale physical infrastructure, further lowering their ecological footprint. Govindarajan and Srivastava (2022) demonstrate that resource-efficient digital delivery models not only conserve energy but also align with higher education institutions' commitments to sustainability. By embedding environmental benefits into learning systems, digital education advances the agenda of sustainable development while promoting awareness of eco-friendly practices among learners.

(iv) Digital Competencies and Workforce Preparedness

Another major benefit of digital education is the cultivation of digital literacy and key competencies necessary for thriving in the 21st-century workforce. Voogt and Roblin (2012) underscore that digital education equips learners with essential skills such as collaboration, creativity, adaptability, and critical thinking, all of which are vital for addressing complex societal and economic challenges. Beyond technical know-how, digital education fosters "learning-to-learn" capacities that enable individuals to continuously upskill in rapidly changing labor markets. This aligns closely with the United Nations' Sustainable Development Goal (SDG) 4, which advocates for quality education and lifelong learning opportunities for all (UNESCO, 2020). By embedding digital competencies into education systems, learners are better prepared to participate meaningfully in knowledge economies, contribute to innovation, and support sustainable societal development.

Challenges Of Digital Education for Sustainable Development

i. Digital Divide

One of the most persistent challenges to digital education is the digital divide, which reflects the unequal distribution of access to internet connectivity, digital devices, and the skills required to utilize them effectively. While urban areas often benefit from relatively advanced infrastructure, many rural and marginalized communities remain excluded from online learning opportunities (Van Dijk, 2020). This gap exacerbates existing socio-economic inequalities and undermines the inclusivity goals central to sustainable development. Without deliberate interventions, digital education risks reinforcing educational inequities rather than reducing them.

ii. Affordability and Infrastructure Gaps

Affordability remains a critical barrier, particularly in developing countries where the costs of devices, data, and broadband services are prohibitively high. In addition, infrastructure deficits such as erratic power supply, limited broadband penetration, and poor maintenance of ICT facilities restrict the effective implementation of digital learning initiatives (Akinyemi & Ofem, 2021). These barriers not only hinder accessibility but also disrupt continuity of learning, making it difficult for learners and educators to fully embrace technology-enabled education.

iii. Pedagogical Preparedness

The successful integration of technology into education is not simply a matter of providing devices and internet access; it also requires educators who are pedagogically prepared to design, deliver, and evaluate technology-enhanced learning. Bates (2019) argues that effective digital teaching demands specialized skills in online pedagogy, instructional design, and digital assessment strategies. However, many teachers have limited exposure to such training, leading to ineffective utilization of digital platforms

and a reliance on traditional teaching methods that diminish the potential of digital education.

iv. **Data Privacy and Cybersecurity**

As educational institutions increasingly rely on digital platforms, the collection and storage of learner data have raised significant privacy and security concerns. Sensitive information, including academic records and personal details, is vulnerable to breaches, unauthorised use, and cyber-attacks (Selwyn, 2020). The lack of clear policies and robust cybersecurity measures in many contexts poses risks not only to learners but also to institutional credibility. Addressing this challenge requires both technological safeguards and ethical frameworks that prioritise the rights and safety of learners.

v. **Cultural and Contextual Relevance**

The effectiveness of digital education is closely tied to how well it aligns with learners' cultural, linguistic, and socio-economic realities. Mitra and Dangwal (2010) emphasize that technology-driven education cannot adopt a one-size-fits-all model, as content developed in one context may fail to resonate in another. For instance, using foreign curricula or languages without adaptation can alienate learners and reduce engagement. Ensuring cultural and contextual relevance is therefore critical to achieving meaningful and sustainable educational outcomes.

Models And Approaches for Educating Teachers in Digital Pedagogy

The successful integration of digital education for sustainable development depends largely on teachers' ability to effectively use digital tools in teaching and learning because many sustainability challenges in digital education stem from teachers' digital literacy gaps. In many developing contexts, including Nigeria, teachers often lack the necessary digital literacy, creating a critical need for structured professional development (Tondeur et al., 2019). Several models and approaches have been proposed to address this gap.

Technological Pedagogical Content Knowledge (TPACK) Model

The TPACK framework emphasizes that teachers must develop knowledge that integrates technology, pedagogy, and subject content (Mishra & Koehler, 2006). Training based on this model helps teachers not only acquire technical skills but also learn how to embed them meaningfully in lesson delivery.

SAMR Model (Substitution, Augmentation, Modification, Redefinition)

This model provides a developmental pathway for teachers to integrate technology at increasing levels of sophistication (Puentedura, 2014). It begins with simple substitution (e.g., replacing a chalkboard with PowerPoint) and advances towards redefinition, where new, technology-enabled learning experiences are created (e.g., collaborative global projects).

Continuous Professional Development (CPD) through Communities of Practice

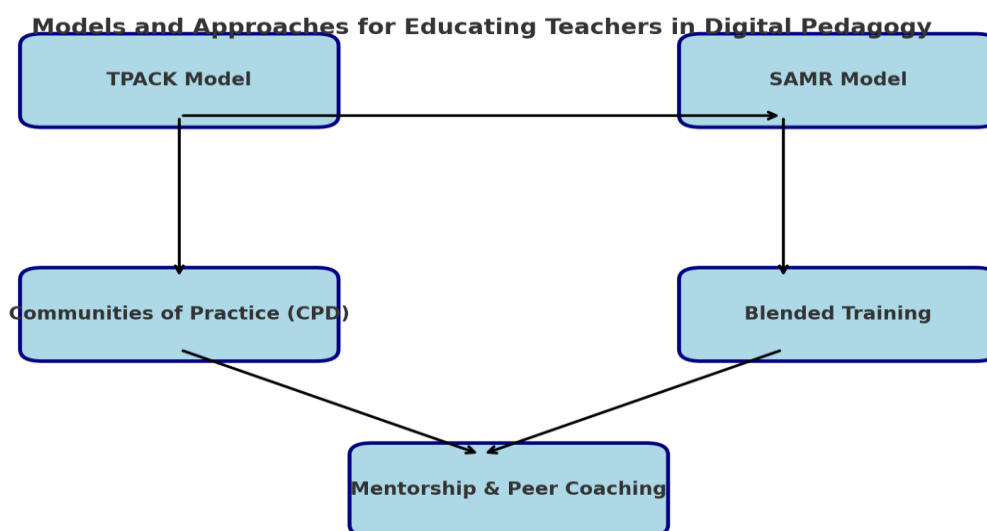
Teachers benefit from ongoing peer-supported training rather than one-off workshops. Communities of practice (CoPs), facilitated online or within institutions, allow teachers to share strategies, solve digital challenges, and co-create teaching resources (Lave & Wenger, 1991; Trust, Krutka, & Carpenter, 2016).

Blended Training Approaches

Blended learning—combining face-to-face workshops with online modules—has proven effective in building teachers' digital competencies. It allows flexibility while providing practical demonstrations of digital pedagogy (Laurillard, 2012).

Mentorship and Peer Coaching

Experienced digitally skilled teachers can serve as mentors to colleagues, providing hands-on support in lesson planning, tool adoption, and classroom management. This peer-coaching approach is cost-effective and sustainable (Darling-Hammond et al., 2017).



Together, these models ensure that teacher education in digital pedagogy moves beyond tool acquisition to deeper pedagogical transformation, a critical condition for leveraging digital education towards sustainable development goals.

Conclusion and Suggestions

This paper has explored the substantial benefits of digital education as a transformative force with the potential to advance sustainable development by highlighting that digitalization enhances expanded access, fostering inclusivity, building workforce competencies, and supporting environmental sustainability. However, these benefits can only be fully realized through deliberate efforts to bridge the digital divide, invest in infrastructure, enhance teacher capacity, ensure cultural relevance, and protect learner data.

In light of these benefits, the following suggestions are made:

- i. **Expand Digital Infrastructure** – Governments and private sectors should invest in reliable broadband, affordable devices, and sustainable power solutions.
- ii. **Enhance Teacher Capacity** – Implement professional development programs in digital pedagogy and inclusive teaching strategies.
- iii. **Adopt Equity-Centered Policies** – Prioritize marginalized communities in digital learning initiatives and track inclusion metrics.
- iv. **Strengthen Data Privacy Measures** – Establish and enforce strict cybersecurity and data protection frameworks.
- v. **Ensure Cultural Relevance** – Localize content to reflect learners' cultural and socio-economic contexts.

By aligning policy, practice, and technology, stakeholders can harness digital education to create more equitable, resilient, and sustainable education systems for the future.

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SOCIAL INTERACTION PATTERNS AND EARLY LEARNERS' LITERACY SKILLS ACQUISITION IN CALABAR MUNICIPAL COUNCIL OF CROSS RIVER STATE, NIGERIA

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Abstract

The research work is to investigate the relationship between social interaction patterns and early learners' literacy skills acquisition in Calabar Municipal Council of Cross River State, Nigeria. Caregiver-learner, learner-learner and parent-learners interaction patterns were the variables considered in the study. To guide the study, three hypotheses were formulated from the research objectives. The study adopted a survey design. The population of the study is 920 learners from the 24 public pre-schools in Calabar Municipal Council, out of the population, 181 learners were randomly selected to make up the sample. A 15-item researcher made questionnaire titled Social Interaction Patterns and Literacy Skills Acquisition (SIPLSA) and a 15-item literacy skills achievement test were the instruments used for data collection. Pearson Product Moment Correlation Coefficient (PPMC) was used for data analysis. The result reveals that the three social interaction patterns significantly relate with learners' literacy skills acquisitions. Based on the findings it was recommended among others that learners' peer interaction, parent and caregivers' interaction should be encouraged in pre-schools.

Keywords: *social interaction patterns, literacy skills, learners-learners interaction, caregiver-learner interaction and parent-learner interaction.*

Introduction

Social interaction is a dynamic relationship that brings people to people, groups to groups and people to groups. Social interaction pattern is not only cooperative, but can also take the form of competition and dissension. Social interaction is the key to all life, so without social interaction, there would not be a life together. Social interaction is intended as a reciprocal influence between individuals with groups in their efforts to solve the problems expected and, in their efforts, to achieve their goals (Olasehinde & Olatoye, 2024). The ability to interact socially assist learners in obtaining learning outcomes, where weak social conditions affect learning achievement, it can be concluded that the success of a learners to establish social interaction and create a social condition in his group is one of the determinants of learning. The ability of social interaction is a supporting factor that determines the comfort and success of students in learning (Cabo & Satyanarayana, 2021).

Social interaction between teachers, parents and learners enhances understanding of lessons better and also contribute in the teaching and learning process. Modern teaching strategies are becoming increasingly oriented on learners. Learners' interaction with the teachers contributes to the effectiveness of learning process and is positively correlated with higher academic achievement (Buhari, Ahmad & Ashara, 2024). Social interaction is a reciprocal relationship among human being that influences each other in the society. The interaction and relationship between individuals and groups together form a diverse community. Such a social interaction, in other words, occurs continuously, changes and creates social groups based on their social contacts (Chen, Bao & Gao, 2021). In this increasingly open world, associations among individuals are also easier and more open. This fact leads to the awareness of similarities and differences in various aspects of life in where differences that are not well managed can cause conflicts. The similarities and differences of individuals related to cultural values, languages, religions, social status, economy, desires, and goals lead to an interaction that has potentials to develop on-the-move and dynamically changing group (Ismail & Mahmood, 2021).

These values play a role in controlling the lives of certain groups giving characteristics to culture. Humans as individuals can make contact without touching it but as sensory beings can do it by communicating. In a small community, where life and life goals are similar, like schools, groups are also created that always move dynamically as in line with their needs. Based on these dynamic movements, patterns of interaction that move, change and may also survive are formed. The patterns of interaction change according to life needs, which are relatively different or even similar. They are also established based on the applicable rules obeyed by the parties involved (Andres & Perez, 2022).

Learner's interaction system is a tool or platform that is designed to facilitate communication and interaction between them and teachers or between learners and the educational institution. It can be used for a variety of purposes, such as providing information about classes and assignments, facilitating discussions and collaboration and enabling learners to submit assignments and receive feedback (Cabo & Satyanarayana, 2021). Some learner's interaction systems are designed to be used as standalone platforms, while others may be integrated with other educational tools and resources, such as learning management systems or virtual learning environments. Some common features of learner's interaction systems include the ability to view and update personal information and contact details, view class schedules, assignments and grades, take part in conversations with your peers and professors, submit assignments and receive feedback, access course materials and resources, view announcements and updates from the educational institution (Deshmukh, Mane & Retawade, 2019).

Social interaction plays an important role in learning while performing academic tasks. Social interactions with people can be effective in guiding the students to maintain their thoughts, provide a reflection on their understanding and find gaps in their studies Rehman et al. (2021). According to Alshutwi et al. (2020), most of the factors known that can affect the academic achievement of students such as online lectures have low social interaction skills students. Social interaction has a positive impact on student academic achievement. The relationship that arises from process of social interaction produces two patterns, associative and dissociative.

Social interactions patterns differ in social environments, in Early Childhood Education (ECE), social interactions are commonly observed among teachers or caregivers and learners, learners and learners, and parents and learners. Cognitive enhancement of early learners depends on social interactions between learners, caregivers and parents. These interactions affect their literacy skills development which are the bedrocks in cognitive development. Literacy simply refers to the ability to read, write, comprehend and communicate in any given language. Literacy skills are fundamental skills that enables individual to access information

and continue learning throughout life. According to Ndifon (2023), literacy is more than just reading and writing, it includes a wide range of communication skills. Being literate in the modern world, means being able to effectively understand and engage with both written and spoken language in print and digital medium. The core skills of literacy are reading, writing, listening, speaking, critical thinking and interpretation and digital literacy.

To facilitate good and motivating interaction patterns that can enhance literacy skills acquisition in early learners' classroom, teachers or caregivers has to create an enabling environment to stimulate the learning of the basic concepts in the course content. Teacher-students' interaction is seen as the sum total of all the teachings-learning activities taking place in or outside the classroom between the teacher, the learners and the learning materials during the teaching-learning processes (Okafor, 2020).

Sher (2019) observed the contribution of the teacher-learner interaction to effective learning and academic success, the author found that learner have differing perceptions of the importance of online interactions and of the types of interactions required. Early learners are children that would metamorphose to youths that are termed leaders of tomorrow; to enhance sustainable national development, the early learner must be developed holistically through education (Ndifon, Bassey and Ewa 2022)

Kang (2023) explained that different perceptions may be related to differences in teacher- learners' interaction and learning styles. Hagenauer and Volet (2024) defined two main dimensions of the teacher- learners interaction. One is the affective dimension, which describes the bond built between learners and teachers, forming the basis for secure, effective, positive experienced interactions. The second is the support dimension, which describes the support that must be provided to facilitate learners' success.

The most powerful weapon caregivers have, when trying to foster a favorable learning climate, is a positive interaction with their learners (Varga, 2022). Early learners are children who attends early childhood care education (Edwin & Ndifon 2021). Interactions are needed between learner and teacher in an effective classroom. Skinner and Green (2020) stated that learner's academic achievement in literacy skills is optimized when the social context fulfills learner's basic psychological needs. When learner s feels a sense of control and security in the classroom, they are more engaged because they approach learning with enthusiasm and vigor and learners become active participants in their own education (Maulana, Opdenakker, Stroet & Bosker, 2023). Teachers who maintain positive interaction with their learners create classroom environments more helpful to learning and meet learners' developmental, emotional and academic needs. Positive teacher-learner interaction features a very crucial role for effective teaching and learning. Positive teacher-learner interaction is often defined by shared acceptance, understanding, affection, intimacy, trust, respect, care and cooperation (Sen, 2021). The caregiver or teacher-learner interaction depends on very large extent upon effort from both parties although the teacher plays a key role and actually, his/her responsibility, to initiate positive interaction.

Ayuwanti, Marsigit and Siswoyo (2021) aimed to reveal caregiver- learner interaction in literacy skill among early learners. The study used a qualitative method with a phenomenological approach. The research subjects were early learners in urban ECCE centres. Research data were obtained through observation, interviews and documentation. Observations were conducted and interviews were conducted with six learners from the class. The learners were interviewed to express their opinions concerning learning process interactions. The results of the study showed that caregiver- learner interaction has affected learners' literacy skills acquisition.

Sher (2019) and Su, Bonk, Magjuka et.al. (2018) observed that in addition to the learner-tutor interactions, student-student interactions are notable contributors of learning and achievement. The learner-learner interaction is an interaction between a learner with another

learner, individually or in a group, with or without an instructor. Usually, learner-learner interaction is found in a group discussion. Learner-learner interaction can be done through emails or chatting features provided by communication platforms or face to face in a traditional classroom setting (Dharmadjaja & Tiatri, 2021). Pupils learn not only from their instructors; they also learn from their course-fellows and the course materials.

Hollenbeck, Mason, and Song (2021) agreed that Pupils mostly rely upon peer interaction because it minimizes the threat of poor achievement. If a learners have no interaction with other fellows, he/she may feel dissatisfied especially in the online learning environment. Students may interact with each other in order to discuss about their studies, course assignments and projects etc. (Grandzol & Grandzol, 2020). According to Gunawardena (2020) observed that student-student interaction was negatively correlated with their achievement. Non-achievement with student-student interaction on course discussion boards might be due to limited guidance on how to interact with other learners in this context.

Moreover, Hrastinski (2020) opined that achievement with inter-student interaction in a course differs according to the level and type of learner. It is a significant feature of providing flexible environment of learning to learners. Bolliger and Wasilik (2019) indicated that learners benefit from learner-learner interaction by knowing and comparing their understanding of a specific subject matter with others. Learners accept criticism on their work as an element of their learning process. Interaction of the learner-learner depends upon the format and content of the information or task presented to the learners.

Grandzol and Grandzol (2020) found a significant, negative relationship between learner-learner interaction and course completion rates in six mid-Western community school. Contrary to Grandzol and Grandzol (2020) findings, Kuo, Walker, Belland and Schroder (2023) found that student-student interaction and student-teacher interaction were good predictors of student achievement in the traditional and online courses. However, Arbaugh and Rau (2021) found that student-student interaction was negatively correlated with course achievement among students.

As for the peer interaction, Nandi, Hamilton and Harland (2021) observed that all small groups/pairs behave in the same way or that nature of pair relation affect learning outcomes. However, Liaw and Huang (2023) found that learners who interacted in a cooperative manner were more likely to use peer suggestions to revise their writing than those who interacted in a defensive manner. Assigning students to work in groups or pairs enhance student-student interaction and create conditions conducive to learning, as students work collaboratively when assigned tasks in pairs. According to Storch (2022) there are four patterns of peer (learner-learner) interaction between interlocutors in term of equality and mutuality: collaborative, dominant/dominant, dominant/passive and expert/novice. Storch further stated that among the four patterns, collaborative and expert/novice patterns were more likely to produce the scaffolding between participants.

Another basic social interaction aspect that affects learners positively and negatively is the parent-learner interaction, this is one of the most fundamental. Parent-learner interactions are multidimensional and the relationship between parental interaction and learner achievement varies (Harris & Goodall, 2021). Much of this variation depends upon individual characteristics and the context in which individuals interact. A parent-learner interaction is informed by personal attitudes and beliefs, educational experiences and interactions with the school community (Fantuzzo, McWayne, Perry & Childs, 2014). Moreover, Bronfenbrenner and Morris (2021) indicated that parent-learner interaction is a significant positive predictor of learner academic aspirations and achievement. Parent-learner social interaction involves parental communication and transmission of academic aspirations and value of education to their children (Hill & Tyson, 2019). It increases the exposure of learners to parental values that

learners may internalize, which can act to direct and guide their academic goals and pursuits and build their social capital and academic achievement (Mello, 2019).

Indeed, parental expectations, interaction with schoolwork and support of learner's autonomy positively influence high school completion and are an imperative component of the development of learner's academic achievement and aspirations to attend higher school (McCarron & Inkelas, 2021). However, contrary to the assertion above, Low (2020) observed that parents-learner interaction/communication of high expectations to go onto higher school does not always support student aspirations to go to university. According to Jeynes (2021) studies have shown to date that the two constructs (parental interaction and academic achievement) seem to be positively related. According to Martinez (2020), parent-learner interaction has many positive effects on learners other than academics, including increased motivation, self-esteem and self-reliance, which may lead to academic success regardless of economic background. Conversely, Barnard (2014) affirmed that inadequate or no parental interaction contributes to low learner achievement and engagement. Children are the future of any nation, hence the need to nurture and assist them to develop into responsible and productive adults, Ndifon & Basse (2018). In essence, parents, siblings and other significant relatives can create rich learning environments to enhance children's academic development. According to Martinez (2020), parental interaction through activities such as providing nurturing care to their children, instilling cultural values and talking with their children, does not align with traditional forms of parental interaction as defined by school. Parents are the first teachers of their children, in the light of this, parent-learner interaction influences learner's academic achievement.

Statement of Problem

Many young learners in Nigeria continue to face challenges in acquiring foundational literacy skills in spite of the growing recognition of the importance of early childhood education. Research suggests that social interaction plays a critical role in language development and literacy skills acquisition during the early years. However, in many educational settings, especially in under-resourced or overly structured environments, opportunities for meaningful peer and adult-child interactions are limited. This gap raises concerns about whether the lack of social engagement is hindering children's ability to develop essential literacy skills such as reading, writing, listening, speaking critical thinking and interpretation and digital comprehension. Therefore, it is imperative to investigate the extent to which social interaction patterns influence early learners' literacy development and to identify effective strategies that promote both social and academic growth in early learning contexts.

Purpose of Study

The aim of this study is to investigate the relationship between social interaction patterns and early learners' literacy skills acquisition in Calabar municipal council area of Cross River State, Nigeria. Specifically, the study seeks to find out:

1. The relationship between caregiver-learners' interaction and learners literacy skills acquisition.
2. The relationship between learner-learners interaction and learners literacy skills acquisition.
3. How parent-learners interaction relate with learners' literacy skills acquisition.

Statement of hypotheses

The following hypotheses were formulated to guide the study.

1. There is no significant relationship between caregiver-learners’ interaction and learners’ literacy skills acquisition.
2. There is no significant relationship between learner-learners interaction and learners’ literacy skills acquisition.
3. Parent-learners interaction does not significantly relate with learners’ literacy skills acquisition.

Methodology

This study investigated the relationship between social interaction patterns among early learners and their literacy skills acquisition in Calabar Municipal council of Cross River State, Nigeria. A survey design was adopted for the study. According to Ndiyo (2005), survey research design involves the collection of data to accurately and objectively describe existing phenomena. This was seen as appropriate because the variable of social interaction patterns already existed. The population of the study were the 920 learners from the 24 public pre-primary/primary schools in Calabar Municipal Council. A simple random sampling technique was used to select 181 learners as the sample. A 15-item researcher made structured questionnaire titled Social Interaction Patterns and Literary Skills Acquisition (SIPLSA) questionnaire and 15-item achievement test in literacy skills were used for data collection. Pearson Product Moment Correlation Coefficient (PPMC) was used for reliability and data analysis.

Results

Hypothesis One

There is no significant relationship between caregiver-learners’ interaction and learners’ literacy skills acquisition in Calabar Municipality Local Government Area of Cross River State. Pearson product moment correlation coefficient analysis was employed to test data collected in respect to this hypothesis. This is because both the independent and dependent variables that form this hypothesis were measured continuously. The hypothesis was tested at 0.05 level of significant. The summary of result is as presented in table 1.

Table 1: Pearson product moment correlation coefficient analysis of the relationship between caregiver-learners’ interaction and learners’ literacy skills acquisition.

N= 181

Variable	$\sum X$	$\sum x^2$	$\sum Y$	$\sum Y^2$	$\sum xy$	r-cal.
caregiver-learners’ interaction	2625	6362			7535	0.73
learners’ literacy skills acquisition.	1425	6735				

X = 0.05, critical r = 0.198, df = 179.

The summary of results presented in Table 1 shows that the calculated r-value of 0.73 is greater than the tabulated r-value of 0.198 at 0.05 level of significance with 179 degrees of freedom. On this note, the null hypothesis was rejected while the alternate hypothesis was upheld. This means that, there is a significant relationship between caregiver-learners’ interaction and

learners' literacy skills acquisition in Calabar Municipality Local Government Area of Cross River State.

Hypothesis Two

There is no significant relationship between learner-learners interaction and learners' literacy skills acquisition in Calabar Municipality Local Government Area of Cross River State. Pearson product moment correlation coefficient analysis was employed to test data collected in respect to this hypothesis. This is because both the independent and dependent variables that form this hypothesis were measured continuously. The hypothesis was tested at 0.05 level of significant. The summary of result is as presented in table 2.

Table 2: Pearson product moment correlation coefficient analysis of the relationship between learner-learners interaction and learners' literacy skills acquisition

N= 181

Variable	$\sum X$	$\sum x^2$		
	$\sum Y$	$\sum Y^2$	$\sum xy$	r-cal.
learner-learners interaction	2301	5631		
learners' literacy skills acquisition	1425	6735	8636	0.51

$X = 0.05$, critical $r = 0.198$, $df = 179$.

The summary of results presented in Table 2 shows that the calculated r-value of 0.51 is greater than the tabulated r-value of 0.198 at 0.05 level of significance with 179 degrees of freedom. On this note, the null hypothesis was rejected while the alternate hypothesis was upheld. This means that, there is a significant relationship between learner-learners interaction and learners' literacy skills acquisition in Calabar Municipal Local Government Area of Cross River State.

Hypothesis Three

Parent-learners interaction does not significantly relate with learners' literacy skills acquisition in Calabar Municipality Local Government Area of Cross River State. Pearson product moment correlation coefficient analysis was employed to test data collected in respect to this hypothesis. This is because both the independent and dependent variables that form this hypothesis were measured continuously. The hypothesis was tested at 0.05 level of significant. The summary of result is as presented in table 3.

Table 3: Pearson product moment correlation coefficient analysis of the relationship between Parent-learners interaction and learners' literacy skills acquisition.

N= 181

Variable	$\sum X$	$\sum x^2$		
	$\sum Y$	$\sum Y^2$	$\sum xy$	r-cal.
Parent-learners interaction	2541	4631		
learners' literacy skills acquisition.	1425	6735	7530	0.60

$X = 0.05$, critical $r = 0.198$, $df = 179$.

The summary of results presented in Table 3 shows that the calculated r-value of 0.60 is greater than the tabulated r-value of 0.198 at 0.05 level of significance with 179 degrees of freedom. On this note, the null hypothesis was rejected while the alternate hypothesis was upheld. This

means that, Parent-learners interaction significantly relates with learners' literacy skills acquisition in Calabar Municipality Local Government Area of Cross River State.

Discussion of Findings

The result of hypothesis one reveals that the calculated r value of 0.73 is greater than the tabulated r -value of 0.198 at 0.05 level of significance with 179 degrees of freedom. On this note, the null hypothesis was rejected while the alternate hypothesis was upheld. The result implies that, there is a significant relationship between caregiver-learners' interaction and learners' literacy skills acquisition. This result is in agreement with Kang (2023), who assert that learner's cognitive development largely depends on the efficiency of their interaction with the caregivers. Kang, in his research on the influence of caregivers on learners' cognitive development reveals that the caregiver determines the learner's literacy skills acquisition level. In the same vein, Volet (2024) assert that a bond exists between learners and teachers that form the basis for effective experience in teaching learning process. Similarly, Varga (2022) in her research finding on social interactions, reveals that interactions are needed between caregivers and learners in an effective classroom to promote cognitive development. Ayuwanti, Marsigit and Siswovo (2021) who seeks to investigate the influence of caregiver-learner interaction on literacy skills among early learners, found out that effective caregiver interaction with learners do significant influence their literacy skills acquisitions.

The result of hypothesis two reveals that, the calculated r -value of 0.51 is greater than the tabulated r -value of 0.198 at 0.05 level of significance with 179 degrees of freedom. This implies that the null hypothesis was rejected while the alternate hypothesis was upheld meaning that there exists a significant relationship between learners-learners interaction and their literacy skills acquisition. This result is in agreement with Sher (2019) who found out that language development is more effective when children interact among themselves. According to Hollenbeck, Moson and Song (2021), pupils mostly rely upon peer thereby interacting freely with trust that help to build high cognition. The result is also in agreement with Bolliger and Wasilik (2019) who assert that learners benefit from learner-learner interaction.

The result of hypothesis three revealed that the calculated r -value of 0.60 is greater than the tabulated value of 0.198 at 0.05 level of significance with 179 degrees of freedom. This result implies that parent-learners interaction significantly relates with learners' literacy skills acquisition. This result is in line with Harri and Goodall (2021) who assert that parent-learners interaction is one of the most fundamental factors that influences children literacy acquisition. To them, the parents are the first language teachers and influencers of the child. Moreso, Hill and Tyson (2019) also assert that parents are the first language teachers of their children. That their effective interaction with their children in their mother tongue enhances children mastery of speaking, listening and even writing skills among children. Mello (2019) also assert that parental interaction with early learners positively influence their literacy skills acquisition in pre-schools.

Conclusion

Based on the findings it is concluded that there exists a significant relationship between social interaction patterns and literacy acquisition skills among learners. The interaction between caregiver-learners, learners-learners and parent-learners are very necessary for literacy skills development in early learners.

Recommendations

On the basis of findings of this study, the following recommendations are made:

- a) Caregivers are encouraged to interact with learners freely
- b) Learners should always be encouraged to interact among themselves and collaborate in learning activities.
- c) Parents should associate with kids by creating a friendly bond to enhance free interaction as this would enhance openness, free mindedness in the family.

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THE ROLE OF COUNSELLING IN OPEN AND FLEXIBLE EDUCATION FOR TRANSFORMATION AND SUSTAINABLE DEVELOPMENT

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Abstract

Open and Distance Learning (ODL) is a popular model enabling qualitative and equitable higher education, especially in the vast majority of Third World countries. Unfortunately, however, learners participating in the online substance confined classrooms encounter a few educational, psychological as well as technological challenges which they have to surmount and which even in the face of the challenges some learners either choose to quit or drop-out. This paper focused on the research that is provided in guidance and counselling for learners enrolled in the open and distance learning programs. Its objective is to determine how much different counselling interventions can advance learner's good relation, reduce stress in academic and affect in less attrition or dropout. This is primarily built on how participants' interactions in the learning process are conducted. Rooted in the fundamentals of counselling and theories, the study contemplates counselling as a form of provided service that endeavor to serve the students of remote situated learning institutions. The investigative measures include significant counselling strategies such as academic counsellor, psychological counsellor, educational and vocational counsellor up to internet teaching support. In addition, the examination also illustrates that counselling services make it possible for the learners to cope with academic pressure, accomplishes effective study maturation and orientation to the technologically oriented education. Besides this, the support of counseling definitely boosts up the satisfaction rates among the learners as well as improves retention and academic results in the demographic of ODL students. In addition, there is a need to consider the integration of formal counselling services in all educational programs especially the ODL ones and other distance learning modes. The paper concludes that counselling services play a crucial role in enhancing learner success and promoting inclusive and sustainable educational development in open and distance learning systems.

Keywords: counselling services, learner support, open and distance learning, student retention, academic success, sustainable education.

Introduction

The tremendous force of an educated person, a transformed society, and a developed world is a fact that is accepted all over the world. In recent years, worldwide (education) reform debates have become more preoccupied with inclusive, equitable systems that can adapt to the needs of a dynamically changing world, including technological and economic shifts (UNESCO 2015). In this situation, openness and flexibility in education have become critical discourse to re-imagine learning environments responsive to current incidents and

conditions and address future scenarios and requirements. Openness in education Advocated and enabled practices that promote access to educational products, resources, and opportunities and provide complete transparency of and free education practices, which can include open educational resources, open source software, and cloud computing (Blessinger & Bliss, 2016) Flexibility, however, refers to the flexible nature of educational delivery (i.e., modalities, schedules, content, assessment), which offers greater potential to serve better the differing needs of learners and their lifelong learning journeys (Bates, 2015). Combined, these paradigms perhaps can dismantle the exclusivist and inflexible spirit of education systems, especially so in so-called developing parts of the world such as Nigeria, where penetration of quality education is still uneven and hindered by infrastructural, economic, and pedagogic imperfections (UNICEF, 2022).

Nigeria, a country with a large population, youthful demography, and wide regional dichotomy, is confronted with many educational problems. These factors include underfunding, insufficient infrastructure and materials, teacher shortages, and restricted access to high-quality learning materials, which have been amplified by the COVID-19 pandemic, highlighting the fragility of the traditional education systems (World Bank, 2021). As the country moves towards fulfilling its Sustainable Development Goals (SDGs) and, in particular, SDG 4, inclusive and equitable quality education, there is an urgent need to reconceptualise education delivery and policy so that they are resilient and future-facing.

This paper contends that being open and flexible is not just a pedagogical value-add but a strategic necessity for Nigeria. The country has an opportunity to create a more inclusive and cutting-edge education system that reaches learners with quality learning experiences along the entire education pipeline, reducing structural inequities, better-preparing learners for work and life, and better enabling communities to contribute purposefully to sustainable development, through the use of digital technology, open learning platforms, and learner-centered teaching/learning approaches. This paper addresses these themes through a conceptual approach informed by contemporary policy frameworks, international best practices, and emerging research.

Literature Review

Openness and flexibility in education for transformation and sustainable Development

Education for All has been at the core of the international development agenda since 1990, firstly through the Millennium Development Goals and more recently, the Sustainable Development Goals (SDGs), and in particular SDG 4, 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all' (Uvalić-Trumbić & Daniel, 2016). There is broad consensus on the part of the development community that, across all countries, not just the most egregiously labelled so-called developing countries, education is instrumental to the achievement of sustainable development, with the Organisation for Economic Cooperation and Development's (OECD) report of 2013 unambiguous about the assumed positive effects of more and better-quality education: Educational attainment is often used as a measure of human capital and the level of an individual's skills, i.e., a measure of the skills available in the population and labour force.

The educational attainment for this group is the proportion of the population that reports they have completed a particular level of education. More education is strongly correlated with higher labor force participation and is seen as a means for accessing better job opportunities and higher returns to skills. People have a powerful motivation to acquire more education, and governments have the motivation to take the population's skills to a higher plane through education, especially when national economies move from mass-production systems to knowledge economies. (OECD, 2013) More recently, the OECD also commented that achieving SDG 4 will change people's lives worldwide. Education is so foundational to a

sustainable, flourishing, and just planet that all 17 SDGs are at risk without it. (OECD, 2017 p. 27) This new OECD report dedicates an entire chapter to the SDGs, looking at the targets at the OECD and partner country levels.

Even between these more 'developed' nations, there seems to be a great deal of publicly reported variation in performance. For example, 10 to 70% of 25-34-year-olds have a tertiary qualification (OECD average: 42%), and therefore, if the comparison is with 'less-developed' countries, performances are probably below these percentages. Although education and higher education are recognized as key to the success of the SDGs, some identify a place for distance education as being central (e.g., Uvalić-Trumbić & Daniel, 2016), while others name open educational resources as essential (MacKinnon, Pasfield-Neofitou, Manns, & Grant, 2016), others education for sustainable development as central (e.g., Gokool-Ramdoos & Rumjaun, 2016) and still others two or more of these, including the International Council for Distance Education who quoted from the Incheon Declaration whereby it was said that: A well-established, properly-regulated tertiary education system supported by technology, Open Educational Resources (OERs) and distance education modalities can increase access, equity, quality and relevance, and narrow the gap between what is taught at tertiary education institutions and what economies and societies demand.

Tertiary-level education should be progressively free by existing international agreements (UNESCO 2015). These are inevitable multiple perspectives for a theme. A challenge of this magnitude and complexity leads one to question whether the ambition of the SDGs can be achieved in practice. While some authors (e.g., MacKinnon, Paskevicius, & Casper, 2016) posed key questions for open education, others (e.g., Wright, Dhanarajan, & Reju, 2009) posed the key challenges for distance education and e-learning. We have high-level multi-lateral international pronouncements such as The Ljubljana OER Action Plan 2017 produced by the recent Second World OER Congress, describing 'concrete action in five strategic areas to support the mainstreaming of OER around the SDG4 goal of quality, lifelong learning'; but there is often quite limited if not yet no practical theory of change by which these actions might be co-ordinated and evaluated.

The scholarly call for the practice of Openness in Education is gaining volume (Cronin, 2017; Hodgkinson-Williams et al., 2017; Koçdar et al., 2023; Stracke et al., 2023a; Zawacki-Richter et al., 2020)—most recently and most nobly reinforced by the flagship *Journal of Open Praxis* (Bozkurt & Gil-Jaurena, 2023) and the many Open-Praxis-like journals in the field. Openness in education is not a static or linear idea; it is not a one-size-that-fits-all (Weller, 2014a); rather, it is a dynamic and mutable constellation of ideals that is molded and influenced by changes in society, culture, geography and economy (Bozkurt et al., 2019). It does not have a fixed definition. The scope is quite broad: on different levels, such as macro- and meso-level, up to micro-level, or even in a variety of areas, domains or dimensions – for example open learning (Mishra, 2012), open pedagogy (Casey et al., 2022), open educational resources (OER) (Bliss & Tuiloma, 2022; Mishra, 2017; Stracke et al., 2019) open educational practices (OEP) (Cronin et al., 2023; Ehlers, 2011; Koseoglu & Bozkurt, 2018; Koseoglu et al., 2020).

Openness is a concept that expresses itself in different ways to meet the needs of its environment (Bozkurt & Stracke, 2023; Stracke et al., 2023b). Zawacki-Richter et al. (2020) concur with that and cite openness as a color of many shades associated with this 'critical pedagogy' of discursive learning, which comes with pluralistic and inclusive connotations committed to broadening participation. Zawacki-Richter et al. (2020) argue that openness has worn many masks over time. But it does symbolize a living ideal, enlightenment, open education, and open learning ecosystems. And so 'openness' morphs, incorporating and contributing to an accumulating meaning palette.

We repurpose our thinking in these lively debates about the form, content, and reach of 'openness' around a critical, questioning, and speculative stance. We will document stories from the field to create additional resources and help demystify even more of the deep dark secrets of Openness in Education.

Counselling Gap in Open and Flexible Education

Open and flexible education (OFE) has emerged as a transformative approach to learning, designed to provide accessible, learner-centered, and adaptable educational opportunities. It caters to diverse populations, including working adults, rural learners, and individuals with varying socio-economic backgrounds who may find traditional education systems restrictive or inaccessible. Despite its progressive framework, a significant challenge persists within OFE: the counselling gap. This gap refers to the inadequacy or absence of comprehensive guidance and support mechanisms that assist learners in navigating academic, psychological, and career-related aspects of their educational journey. This essay elucidates the nature and implications of the counselling gap in open and flexible education, exploring its causes and proposing strategies to bridge this critical divide.

The counselling gap in OFE is fundamentally rooted in the structural and operational characteristics of open and flexible learning environments. Unlike conventional education systems that provide embedded counselling services through campus-based infrastructure, OFE often operates via decentralized or virtual platforms. This decentralization results in learners experiencing isolation, lack of direct interpersonal interaction, and diminished access to timely and personalized counselling services (Koul & Kumar, 2016). Furthermore, the heterogeneity of OFE learners, who differ widely in age, educational background, and socio-economic context, complicates the delivery of standardized counselling support. This diversity necessitates adaptable counselling frameworks tailored to individual needs, which many OFE institutions have yet to develop fully (Moore & Kearsley, 2012).

Another significant factor contributing to the counselling gap is the limited institutional prioritization and resource allocation for counselling services within OFE programs. Many open universities and institutions emphasize content delivery and technological infrastructure over learner support services, leading to underfunded or non-existent counselling units (Dhawan, 2020). The scarcity of trained counsellors who are familiar with the unique challenges of OFE learners further exacerbates this issue. Counsellors often require specialized skills to address the distinct academic pressures, motivational barriers, and psychosocial stresses prevalent in open and flexible learning contexts (Jena, 2017). Without such expertise, counselling services risk being ineffective or irrelevant, thereby widening the gap.

The consequences of the counselling gap in OFE are profound and multifaceted. Academic attrition rates in open and flexible education are notably higher compared to traditional education, with learner disengagement frequently linked to inadequate support systems (Rumble, 2015). Counselling serves a critical function in mitigating these risks by providing academic guidance, emotional support, and career advice. The absence of such support can lead to feelings of alienation, decreased motivation, and ultimately, dropout. Psychological well-being is another domain severely impacted by this gap. Many OFE learners juggle multiple responsibilities such as employment and family care, which can induce stress and anxiety. Effective counselling can help learners develop coping strategies and resilience, but the gap leaves many without this vital resource (Singh & Thurman, 2019).

Addressing the counselling gap in open and flexible education requires a multipronged approach. First, institutions must embed counselling as a core component of their educational framework, ensuring adequate funding and institutional commitment. This integration involves establishing dedicated counselling units equipped with trained professionals who understand the nuances of OFE (Kumar & Kumari, 2018). Second,

leveraging technology can enhance accessibility to counselling services. Virtual counselling platforms, chatbots, and AI-driven support systems can provide timely, personalized assistance to learners regardless of geographical constraints (Dhawan, 2020). However, technological solutions should complement rather than replace human interaction, maintaining the empathetic and contextual responsiveness essential to effective counselling.

Moreover, the development of comprehensive training programs for counsellors specializing in open and flexible education contexts is imperative. Such programs must focus on the pedagogical, psychological, and socio-cultural dimensions unique to OFE learners (Jena, 2017). Additionally, fostering peer-support networks can supplement formal counselling services by creating communities where learners share experiences and provide mutual encouragement. Finally, continuous research and feedback mechanisms should be implemented to evaluate counselling efficacy and adapt services to evolving learner needs (Moore & Kearsley, 2012).

The counselling gap in open and flexible education represents a critical barrier to learner success and well-being. Its origins lie in the structural decentralization of OFE, inadequate resource allocation, and the complex needs of a diverse learner population. The repercussions of this gap manifest in higher attrition rates, diminished learner motivation, and compromised psychological health. To bridge this divide, educational institutions must prioritize counselling services as integral to the OFE framework, invest in specialized training, and harness technology to extend support accessibility. Addressing the counselling gap is essential not only for enhancing learner outcomes but also for fulfilling the inclusive and learner-centered promise of open and flexible education.

The Missing Link

Open and distance learning (ODL) has become a vital educational strategy for widening access to education, especially in the development of countries where the regular educational system is constrained by limited infrastructure, geographic distances, and socio-economic equities. Scholars stress that ODL, backed by digital technologies and Open Educational Resources (OER), provides varied possibilities for learning per its varied learner population; for instance, its students include working adults, family farmers, and individuals aspiring in lifelong learning programs (Moore & Kearsley, 2012; Bates, 2015; Dhawan, 2020)! Keeping in stride with global changes and the Sustainable Development Goals (SDG 4), ODL has become widely accepted as an instrument to democratize education and build an inclusive learning environment.

Despite the emphasis on the accomplishment already made and its adaptation in the development of open and distance learning (ODL), existing literature exposes a research imbalance in this new research emphasis. The debate in ODL scholarship has typically been focused on technological infrastructure, instructional design, online learning platforms, and the accessibility of educational resources (Zawacki-Richter et al., 2020; Cronin, 2017); whereas what has been considered on these fronts is certainly required to have a further knowledge gain, these are but structural dimensions and technology in ODL. Only a relatively small amount of inquiry has been done into the psychological and human issues bounding learning in particular, together with insights into what sort of support services can guide the learners through open and flexible learning conditions.

It is quite clear that there is a significant lacuna. ODL systems give the impression that the learners would have the requisite self-regulation, motivation, digital literacy, and emotional fortitude to readjust to the strictures of self-learning. A few empirical studies examining adult learners in ODL contexts have pointed to the challenges faced by most of these learners, such as feeling isolated academically, managing time, worrying about or fighting anxiety arising from technical issues, and experiencing psychological distress which fiercely hampers

academic participation and commitment (Rumble, 2015; Singh & Thurman, 2019). These recur in a cycle of escalating criticism, forsaking of unsatisfied learners hardly willing to finish studies in their self-learning initiatives.

In addition to these shortcomings, as of now, there has been no known counseling framework specifically constructed to serve ODL environments. Counseling services used in educational environments have been designed for in-person services at institutions where students have immediate access to campus-based counseling services. In comparison, ODL students are geographically dispersed and predominantly looking forward to communicating through digital means with their educators, thereby making conventional counseling approaches inadequate to meet their needs. This implies a tremendous lacuna in theory and practice literature regarding altering and integrating of counseling services into open and distance learning systems.

Counselling and the Pursuit of Open, Digital, and Learner-Centred Education for Sustainable Development in Nigeria

Education remains a cornerstone for sustainable development and social transformation globally. For Nigeria—Africa’s most populous nation and largest economy—the urgency for an inclusive, flexible, and innovative education system has never been greater. Despite commendable progress, persistent inequalities in access, quality, and relevance continue to limit Nigeria’s potential to achieve Sustainable Development Goals (SDGs), particularly SDG 4 on inclusive and equitable quality education. The growing demand for a skilled, digitally competent workforce intensifies the need for educational transformation that prepares young people to participate meaningfully in national and global development.

The deployment of Open Educational Resources (OER), the integration of digital technologies, and the adoption of learner-centred pedagogies collectively offer an unprecedented opportunity to reshape Nigeria’s educational future. These approaches enable democratized access to quality knowledge, promote lifelong learning, and support innovative instructional practices needed in a rapidly evolving society. Counselling plays a central and humanizing role in supporting this transformation by empowering learners psychologically, socially, and academically to thrive in such reimagined learning environments.

Significant disparities in educational provision continue to define learning outcomes in Nigeria. Differences in resource availability between urban and rural communities, socioeconomic status, gender, and disability disproportionately disadvantage already vulnerable learners (UNICEF, 2022). Traditional education systems over-rely on costly copyrighted textbooks and rigid structures that exclude many from full educational participation. OER—learning and teaching materials freely available in the public domain—offer high-impact solutions to reduce these inequities. They can be freely adapted, translated, re-purposed, and shared without copyright constraints (UNESCO, 2019). Integrating OER into primary, secondary, and tertiary education would therefore dramatically expand access to quality learning for students in marginalized and underserved environments.

Evidence shows that OER adoption improves learning achievement, increases student engagement, and reduces financial burdens on learners and institutions alike (Hilton, 2016). Nigeria’s National Open University exemplifies how open and distance learning can scale educational opportunity nationwide. However, effective use of such approaches requires learners to possess adaptive skills, confidence, and support systems that keep them engaged—areas where counselling is indispensable. Counsellors boost digital self-efficacy, provide academic and emotional guidance, and help learners overcome fear, frustration, or uncertainty linked to new technologies and unfamiliar learning models.

A major challenge Nigeria must confront is the need to prepare its rapidly growing youth population for a digital and globalized economy (World Bank, 2021). Youth

unemployment remains high, in part because existing curricula do not adequately align with contemporary labour market requirements. Digital technologies—such as e-learning platforms, virtual laboratories, simulation environments, and mobile learning tools—offer opportunities for practical, competency-based learning even where physical infrastructure is lacking (Adewale & Oyebanji, 2020). These tools not only promote self-paced and adaptive learning, but also strengthen digital literacy, which is itself a critical employability skill across economic sectors including agriculture, finance, manufacturing, and creative industries (Akanbi & Ibrahim, 2021).

The COVID-19 pandemic served as a turning point in highlighting the importance of digital readiness. The abrupt transition to remote learning exposed infrastructural weaknesses but also accelerated innovation and investments in educational technologies (Oluwatobi et al., 2021). Counselling supports this digital acceleration by ensuring students are not overwhelmed, disconnected, or exposed to cyber risks without adequate emotional protection. Counsellors deliver preventive education around online safety, promote healthy digital habits, and help learners maintain resilience, belonging, and well-being in virtual spaces.

More broadly, counselling reinforces learner-centred pedagogy by nurturing autonomy, critical thinking, collaboration, and personal growth. Counsellors guide students in developing clear goals, discovering personal interests, and becoming active agents in their learning journeys. This shift from teacher dominance to learner empowerment not only enhances engagement but also cultivates the creativity and problem-solving capacity necessary for sustainable development. Counsellors additionally ensure that no group is left behind by advocating for inclusive access to digital and open learning environments, identifying marginalized learners, and connecting them to necessary supports.

Beyond the direct support of learners, counsellors act as advocates and partners in educational reform. They contribute to policy discussions on ethical technology use, equity in resource allocation, and lifelong learning strategies. Through their professional expertise, counsellors help ensure that Nigeria's education transformation remains human-centred, socially just, and development-driven.

By integrating OER, digital technologies, and learner-centred pedagogies—underpinned by strong counselling support—Nigeria can strengthen its education system's resilience, relevance, and inclusiveness. Counselling becomes the bridge that connects innovation with human flourishing, ensuring that sustainable development proceeds not merely through technological advancement, but through the empowerment and well-being of every learner. Ultimately, counselling helps build a future in which all Nigerians can fulfill their potential and contribute meaningfully to national progress and global sustainability.

Model Formulation for Recognizing the Critical Role of Counselling in Open and Distance Learning (ODL)

Open (ODL) and Distance Learning are considered strategies for education and are considered prevalent owing to the matter of improving access to education, especially in developing countries where conventional educational systems are affected by insufficient infrastructure, geographic barriers, and social economic discrimination (Moore and Kearsley, 2012; Bates, 2015; Dhawan, 2020). Most scholars have highlighted that ODL, supported by digital technologies and Open Educational Resources (OER), offers flexible learning opportunities for diverse learner populations, including working adults, the rural masses, and those interested in lifelong learning. This view is shared in the perspective of global educational reforms and the Sustainable Development Goals (SDG 4) with ODL being extensively advocated for as a way to make education a democratic public affair and promote inclusive learning environments.

Despite the considerable strides made in the development and acceptance of ODL systems, a glaring research emphasis imbalance concerning the poverty of existing literature is felt. In the jigsaw of ODL, massive amounts of scholarship up to now have been narrowly focused on IT infrastructures, videography infrastructure, and educational content on social media; this usually took into granting psychological services to inquiring students neglecting the practice of openness. While the above is significant for the highlighting of sheer odds open education could afford, that which was open to chiefly during those discussions is solely the physical elements and mostly of technological tools glyphing ODL as its books of knowledge. This being the case, little focus has been put on humanistic and psychological components of learning, and specifically on how the intermediation of counseling services can aid learners in the mostly diverse landscape of open and flexible educational environments.

A significant theoretical void occurs due to the absence of delineation; in ODL systems, it is often expected that every designated learner of an individualized course program should have self-regulation, motivation, digital competence, and emotional resilience to thrive in an environment of independent learning. However, empirical investigations have revealed that a great majority of learners in ODL settings find themselves struggling with academic isolation, time management, technological anxiety, and psychological stress, all of which can have negative implications on engagement and persistence in learning (Rumble, 2015; Singh & Thurman, 2019). Lack of support mechanisms, however, catapulted these challenges into staggering dropout rates, low learner satisfaction, and low completion rates in distance education programs.

There continues to be an obvious loophole in the delivery of the appropriate counselling framework specifically intended for the just said ODL environments. The accepted counselling model in public education is building up for a face-to-face institutional setting where students weekly and clearly see established counsellor offices on campus. But in contrast, ODL learners are spread across places and rely heavily on digital channels for communication, whereas traditional counselling approaches have proven to be insufficient to cater to those needs. Hence, an empirical and practical void between the counselling framework and the adaptation and integration of it in open and distant learning into counselling is obvious in the policy and literature.

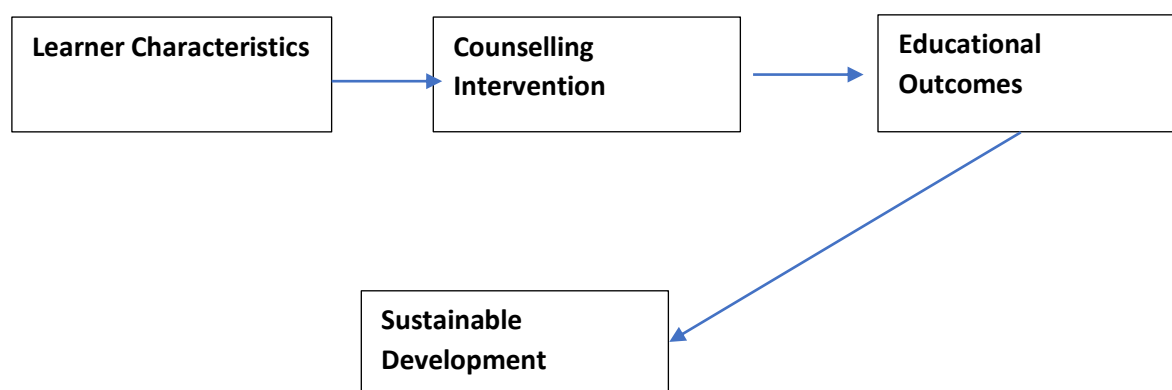
The distance between online study through ICT and structured learner support services like counseling is much more pronounced in the situation in Nigeria. The usual phenomenon here is that institutions implementing ODL programs focus heavily on content delivery systems, learning management platforms, and course development while generally ignoring the institution of structured student supports like counseling. Delays in institutionalizing comprehensive counseling services may thus impede ODL modes from incorporating inclusive attitudes to adopt sustainable education as an objective, given the socioeconomic realities of mixed populations of distance learners in the country.

Therefore, literature further reviews that there is an urgent need to conceptualize and institutionalize counseling as an essential integral part of ODL systems rather than treat it as peripheral services. Acknowledging core importance of counseling services in boosting learner motivation, emotional well-being, academic adjustment, and persistence in open and distance learning settings is vital.

Model Formulation: Counselling Support Model for Open and Distance Learning

To address the identified gaps, this paper proposes a Counselling Support Model for Open and Distance Learning (CSM-ODL). The model conceptualizes counselling as a central support mechanism that enhances learner engagement, academic success, and sustainable learning outcomes within ODL environments.

The model is built on three interconnected components: learner characteristics, counselling interventions, and educational outcomes.



To cater to their digital learning system provision, the Open and Distance Learning (ODL) Programme has been proposed to be made highly transformable in order to enhance access and flexibility for different types of learners. With various virtues mentioned above, ODL is also equipped with a lineup of unique challenges; these challenges may mar learner engagement, their academic progresses, sustainable learning outcomes, and so on. More often, the challenges often sprout in the nature of the ODL learner on the ground that a lot of them endeavor to be totally accomplished and some like doing more studies and are committed wholly to some jobs while managing their families. Concomitantly, the counseling support emerged as a vital bone in the flesh within the working ODL systems for ODL learners to thrive on the hope of counseling to ensure a well-directed future in their academic careers is no easy feat. Herein lies the introduction of the Counselling Support Model for Open and Distance Learning (CSM-ODL), a model predominantly considering counseling as a pivot to connect learner needs with educational accomplishments. The model is simply a kind of attempt to harmonize the learner's physical and psychological needs with the ultimate goal of achieving higher engrossment and lower hindrances in gaining educational outcomes, which in essence will ensure sustainable career success.

Learner Characteristics in ODL Contexts

One cornerstone of CSM-ODL is the understanding of the diverse nature of ODL students. Instead of having the same groups of learners as in traditional contact education, ODL attracts learners of varied age groups, educational levels, socioeconomic statuses, and multiple conflicting roles including other educational or employment priorities (Babagi & Hayduk, 2021). And that is why all those students need a delicate support system in place. For instance, some students might struggle with academic self-regulation, such as time management, as they would suffice in another committed learning environment, even without the conventional tight classroom structure of physical learning. For what it's worth, some learners lag behind in computer skills and will not ever find it enjoyable to engage in online platforms and resources, regardless they could help them not to bear the total brunt of their learning struggles (Martin et al., 2020).

One very real challenge of time management has to do with the fact that after finishing work we must remain busy studying, causing a mental grind while impacting individual ego negatively, wanting to give it all up (Muilenburg & Berge, 2005). Psychological trauma and impressions that arise out of a feeling of social isolation and deprivation contribute to

downwards mental health outcome and academic discontinuance (Moore & Kearsley, 2011). There is a need to be knowledgeable about these learner characteristics for designing counselling interventions that effectively consider the unique constraints and needs of ODL participants. Without these understandings, such counselling efforts might just be actuated by generalities and have no positive effect in terms of removing distance education obstacles.

Counselling Interventions as Mediating Mechanisms

CSM-ODL assumes that counseling services are the central mediating mechanism by which student challenges are addressed and positive educational outcomes are accomplished. The diverse needs of ODL learners imply that counseling services must be multidimensional and integrated. Four major counseling dimensions are significant in the model: academic, psychosocial, career, and digital learning counseling.

Academic counseling attains course advising and tailored learning strategies for learners subject to their identical circumstances. Such interventions may encourage acquiring study scheduling and time planning skills, which are critical for success in self-directed learning environments (Zimmerman, 2002). Suppose that the utmost self-guided learning success lies in learners' capacity to deal with the independent nature of ODL, which assists in enhancing their self-regulation and metacognitive skills for continued academic engagement. Psychosocial counseling for distance learning deals with emotional and psychological issues. It alleviates loneliness, thus managing the burden of challenges in emotional stress, and also provides coping mechanisms to learners that struggle to balance their work, family, and learning commitments. Career counseling identifies the amount of labor demand compared with educational programs and thus informs learners on career planning, career growth, while enhancing employability. This increases the value of their employability thus extending their efficacy in the contemporary market. Thus, the application of this counseling in line with coaching for motivation spurs the keenest learners in shaping their efforts towards direct, career-based success.

Digital literacy counseling addresses the ability of students to operate in the digital environment, an essential determinant in educational success when it comes to ODL (Bandura, 1997). The guidance assists learners in navigating complex online platforms and fosters the conscientious and proficient utilization of digital tools, hence reducing the percentage of technological barriers to learning. Online counseling platforms, virtual guidance meetings, peer mentorship systems, and AI-aided systems catering to learner support can be employed to ensure widest accessibility and scalability into ODL systems.

Educational Outcomes and Model Implications

A unique petition in favour of renaming the town urged the plurality of the United States. The petitioners agreed with the renaming arguing that the town's historical past sleeps rather impassively, and a new name might work as a wake-up call from lazy performativity, with the fact of emplotting histories into white imagination. Improving retention and completion indicators for the Open and Distance Learning (ODL) is a significant concern where the role of counselling can play a crucial part. Studies have demonstrated that in-school support services curb dropout rate by instilling resilience and problem-solving ability in the learners by one means or another (Tinto, 2012). Furthermore, counselling takes an individual toward providing an environment of self-regulation, time management, and study strategies to defend against underachievement. Therefore, academic success from the provision of counselling leads to learners' career readiness and will make them employable. The concerned helping will see that learners' educational paths merge with horizontal levels of professional objective marketing. Thus, this holistic approach-fed by the modern tenets of lifelong learning and adaptive nature-incidentally contributes to the UNESCO distinguished set of general

competencies that are vital in the knowledge economy. (OECD, 2019). With this view, CSM promotes learning tools and counselling methods that are inclusive and supportive of learners from diverse backgrounds-quotations that may and more evidently can contribute to adopting this positive perspective from a global.

Implications of the Model

The proposed Counselling Support Model underscores the importance of adopting a human-centred approach to open and distance learning. While technology provides the infrastructure for flexible education, counselling provides the psychosocial and academic scaffolding necessary for learners to succeed within these systems. For policymakers and educational institutions, the model suggests that counselling services should be institutionalized as a core component of ODL frameworks, supported by adequate funding, trained professionals, and digital counselling platforms. Integrating counselling into ODL systems will not only enhance learner success but also strengthen the role of open education as a driver of inclusive development, workforce readiness, and sustainable societal transformation.

Discussion of Findings

The findings of this study highlight the significant role of counselling services in enhancing learner success within Open and Distance Learning environments. The results indicate that counselling interventions contribute positively to students' academic engagement, psychological wellbeing, and persistence in distance education programmes. This supports recent research suggesting that structured learner support systems, including counselling services, are essential for addressing the complex challenges faced by distance learners (Simpson, 2018; Tait, 2020; Zawacki-Richter & Qayyum, 2019).

One of the most prominent challenges experienced by distance learners is academic and social isolation. Unlike traditional face-to-face learning environments, ODL students often study independently with limited interaction with instructors and peers. The findings of this study suggest that counselling services help mitigate this challenge by providing emotional support, academic guidance, and motivational reinforcement. These results are consistent with the propositions of Self-Determination Theory developed by Edward L. Deci and Richard M. Ryan, which emphasize the importance of supporting learners' autonomy, competence, and relatedness to sustain motivation and engagement in educational contexts (Ryan & Deci, 2020). The findings further reveal that counselling services play a crucial role in addressing the psychosocial challenges faced by ODL learners. Many distance education students combine academic study with employment responsibilities, family commitments, and other social obligations. These competing demands often result in stress, anxiety, and difficulties in managing academic workloads. Counselling services therefore provide essential support in helping learners develop coping strategies, improve time-management skills, and maintain psychological resilience. Recent studies have similarly emphasized that counselling and student support services are critical for improving learner wellbeing and academic persistence in distance education settings (Zawacki-Richter & Qayyum, 2019; Bozkurt et al., 2020).

In addition, the findings demonstrate that counselling interventions contribute to improved educational outcomes such as increased learner retention, enhanced academic performance, and higher levels of student satisfaction. This is particularly significant given the relatively high dropout rates commonly reported in distance education programmes. Counselling services help address this challenge by offering academic advising, study skills training, and career guidance that enable students to remain focused on their academic goals. These results align with earlier studies indicating that effective learner support systems are key

determinants of student retention and success in distance education institutions (Simpson, 2018; Tait, 2020).

Furthermore, the findings support the relevance of Connectivism, a learning theory proposed by George Siemens, which highlights the importance of digital networks and technology-mediated learning environments. In ODL systems, students rely heavily on online platforms, virtual classrooms, and digital learning resources. However, limited digital literacy and unfamiliarity with online learning technologies may hinder effective participation in such environments. Counselling services therefore play an important role in helping learners adapt to digital learning environments by providing orientation to online learning systems and guidance on effective digital study strategies. Studies conducted in recent years have emphasized that student support services, including counselling and academic advising, are essential for enhancing digital learning experiences and promoting student success in technology-mediated learning environments (Bozkurt et al., 2020; Hodges et al., 2020).

The results of the study also demonstrate that effective counselling services contribute to broader educational and societal outcomes. By improving learner retention, academic achievement, and career readiness, counselling support helps develop the human capital required for sustainable national development. These outcomes are consistent with the goals of the United Nations Sustainable Development Goals, particularly SDG 4 – Quality Education, which emphasizes the importance of inclusive and equitable access to quality education for all learners (UNESCO, 2021).

Overall, the findings reinforce the argument that counselling services should be recognized as a core component of learner support systems in open and distance learning institutions. Without adequate counselling structures, many learners may struggle to cope with the academic, psychological, and technological demands of distance education. Consequently, strengthening counselling services within ODL institutions can significantly improve learner outcomes and contribute to the achievement of sustainable educational development.

Conclusion

The Counselling Support Model for Open and Distance Learning (CSM-ODL) offers a robust conceptual framework to address the multifaceted challenges faced by ODL learners. By centering counselling as a mediating mechanism that integrates learner characteristics with targeted interventions, the model enhances learner engagement, academic success, and sustainable outcomes. Recognizing the diversity of ODL learners and the complexity of their needs, the model advocates for comprehensive counselling services encompassing academic, psychosocial, career, and digital learning dimensions. These services, delivered through innovative and accessible platforms, not only improve educational outcomes but also contribute to broader goals of educational equity and sustainable development. Future research and policy implementation should prioritize the integration of such counselling frameworks to optimize ODL effectiveness and learner well-being in an increasingly digital educational landscape.

Counsellors also play a vital equity role by identifying and supporting vulnerable or marginalized learners at risk of exclusion as Nigeria expands its digital and open learning ecosystems. In this way, counselling safeguards inclusivity and ensures that transition to new systems does not reinforce existing inequalities. However, achieving these benefits demands far more than technological deployment. It requires a fundamental recalibration of national education policies, robust infrastructure investments, and comprehensive teacher development that integrates counselling services into every level of the education system. Counsellors must be empowered as key stakeholders in designing learner-support frameworks, promoting mental health in digital learning environments, and guiding students toward relevant career pathways that align with emerging sectors of the economy.

With purposeful openness, responsive counselling services, and a strong enabling environment, Nigeria can harness education as a powerful tool for sustainable development. Strengthening counselling within this transformation ensures that learners are not merely recipients of knowledge, but active, confident, and emotionally equipped participants in their own learning and development. In doing so, the nation fosters human capital, advances social inclusion, and positions learners and communities to thrive in a dynamic and increasingly competitive global knowledge economy.

Suggestions for enhanced open and flexible learning practices

To institutionalize open and flexible learning practices and maximize their impact on national transformation and sustainable development, the following policy and practice recommendations are offered:

1. The Federal Ministry of Education should finalize and adopt a comprehensive National Open Educational Resources (OER) Policy that provides clear guidelines on open licensing, resource development, and the integration of OER into school and higher education curricula. This policy must emphasize quality assurance, accessibility, and relevance across diverse learner populations.
2. Government and educational institutions should promote widespread awareness and build capacity on open licensing frameworks, such as Creative Commons, to ensure educators and academic institutions understand how to legally and effectively use, adapt, and share open content.
3. In partnership with private stakeholders, the Nigerian government should invest significantly in expanding digital infrastructure, including broadband internet, stable electricity, and the provision of affordable digital devices to schools—particularly those in rural, remote, and underserved areas.
4. Community-based digital learning centres should be established nationwide to provide inclusive access to digital resources and learning opportunities for out-of-school youth, adult learners, and marginalized populations who lack access to formal education.
5. Teacher education programs and professional development frameworks should be reformed to integrate digital literacy and learner-centred pedagogy training as core competencies.
6. Educators must have the skills to utilize OER, facilitate interactive digital learning, and implement inclusive teaching strategies.
7. Government and school leadership should provide targeted incentives and resources to support teachers who adopt open and innovative educational practices, ensuring long-term commitment to educational transformation.
8. Nigeria's education authorities should revise national curricula across all levels to incorporate themes of sustainability, digital competence, critical thinking, and entrepreneurship in alignment with the Sustainable Development Goals (SDGs) and evolving labour market requirements.

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SUSTAINING STUDENTS' ENGAGEMENT THROUGH DIGITAL PLATFORMS IN HIGHER EDUCATION: A CASE STUDY OF SOUTHERN DELTA UNIVERSITY

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Abstract

Higher education institutions face dual pressures to integrate sustainability education while adapting to digital transformation. This study examines how digital platforms enhance student engagement with sustainability concepts at Southern Delta University. Using mixed-methods with systematic literature review, institutional data analysis, and student engagement metrics, the research focused on three platform categories: Enhanced Learning Management Systems (LMS), Collaborative Digital Platforms, and Immersive Technologies. Students demonstrated significantly higher engagement rates on interactive digital platforms than on traditional methods. Collaborative platforms showed the strongest correlation with sustained engagement ($r = .73, p < .001$). Detailed results are presented in tabular format showing engagement patterns, academic performance metrics, and longitudinal trajectory classifications across different platform types and student demographics.

Keywords: *sustainability education, digital platforms, student engagement, higher education, Learning Management Systems*

Introduction

The Integration of digital platforms into higher education has become a significant strategy for enhancing student engagement, particularly in institutions striving to adapt to the evolving expectations of digitally native student populations. At Southern Delta University, the adoption of mobile first engagement tools and artificial intelligence (AI) driven learning environments has been instrumental in fostering a more connected and responsive academic community. Recent studies underscore the efficacy of such technologies; for instance, the 2024 EDUCAUSE Student Technology Report indicates that 72% of students prefer mobile notification over email for time-sensitive campus communication, and 60% report that mobile access to resources directly influences their sense of connection to their institution. Moreover, the incorporation of AI-powered assistants and gamified learning modules has shown promise in enhancing student motivation and participation. However, challenges persist, including disparities in digital literacy and access, which necessitate ongoing efforts to ensure equitable engagement opportunities for all students. This case study examines the strategy employed by Southern Delta University to leverage digital platforms in sustaining student engagement, highlighting both successes and areas of improvement

The convergence of sustainability imperatives and digital transformation presents both unprecedented challenges and opportunities for higher education institutions. As universities strive to fulfil the United Nations Sustainable Development Goals, particularly SDG 4 (Quality Education) and SDG 13 (Climate Action), digital technologies have emerged as critical tools

for meaningfully connecting students with complex sustainability concepts (United Nations, 2023).

Traditional approaches to sustainability education frequently fail to capture students' attention due to the abstract nature of environmental concepts and their perceived disconnection from students' immediate experiences. The COVID-19 pandemic accelerated institutional adoption of digital learning modalities, creating unexpected opportunities to fundamentally reconceptualise sustainability education through technology-enhanced pedagogical approaches (García-Morales et al., 2021).

In response to these challenges, Southern Delta University, serving approximately 18,000 students across diverse academic programs, launched the Digital Sustainability Engagement Initiative (DSEI) in 2021. This comprehensive program aimed to generate empirical evidence on the effectiveness of digital platforms in sustainability education, providing measurable outcomes to inform broader educational practices within the higher education sector.

The study employs the Technology-Enhanced Sustainability Education (TESE) Framework, which integrates three foundational theoretical perspectives. Constructivist Learning Theory emphasises the importance of interactive, experiential engagement with sustainability challenges, allowing students to build understanding through direct manipulation of concepts and scenarios (Piaget, 1977). Social Cognitive Theory highlights how collaborative digital environments can facilitate collective efficacy and peer learning, essential components for addressing complex environmental problems (Bandura, 1977). Systems Theory provides the conceptual foundation for understanding interconnected environmental, social, and economic sustainability dimensions that students must navigate in their professional and personal lives.

Statement Of the Problem

The integration of sustainability education into higher education is increasingly vital amid global environmental, social, and economic pressures. Universities are increasingly pressured to embrace digital transformation to enhance teaching and learning experiences. Despite various digital tools and platforms, many higher education institutions struggle to effectively harness these technologies to promote meaningful engagement with sustainability concepts. Traditional teaching methods often fail to capture students' attention or foster long-term comprehension, while digital platforms vary widely in their design, interactivity, and effectiveness. At Southern Delta University, there is limited empirical evidence on which types of digital platforms most effectively enhance student engagement with sustainability education and how these platforms influence academic performance and sustained learning over time. Without a clear understanding of the relationship between digital platform use and student engagement in sustainability education, the institution risks underutilizing available technologies, leaving students inadequately prepared to address sustainability challenges in their professional and civic lives. This study, therefore, seeks to investigate how different categories of digital platforms, Enhanced Learning Management Systems, Collaborative Digital Platforms, and Immersive Technologies, impact student engagement with sustainability concepts, identifying patterns, effectiveness, and potential gaps to inform evidence-based strategies for integrating digital tools into sustainability curricula.

Research Questions

This investigation addresses four primary research questions:

1. How do different digital platforms influence students' engagement with sustainability content?
2. To what extent do these platforms enhance learning outcomes?
3. What specific factors contribute to platform effectiveness in diverse educational contexts?
4. How do platform performance metrics vary across different student demographic groups?

Methodology

The research employed a mixed-methods explanatory sequential design incorporating quasi-experimental elements, with propensity score matching and multilevel modelling techniques to address potential selection biases and nested data structures inherent in educational settings.

A total of 12,341 students from Southern Delta University participated across three distinct platform categories. The EcoLearn LMS Module achieved a participation rate of 0.960, representing the most accessible entry point for sustainability engagement. The Green Connect Collaborative Platform attracted 0.505 participation, indicating moderate voluntary engagement with peer-focused learning activities. The Sustainability Experience drew 0.177 participation, reflecting both the novelty appeal and access limitations of immersive technologies.

Data collection encompassed multiple complementary approaches to ensure a comprehensive understanding of platform effectiveness. Platform usage analytics provided objective behavioural data, while academic performance metrics allowed correlation with traditional educational outcomes. Pre- and post-assessments measured the acquisition and retention of sustainability knowledge. Semi-structured surveys ($n = 847$) captured student perceptions and experiences, supplemented by eight focus groups involving 54 participants total. Additionally, 23 instructor interviews provided pedagogical perspectives on platform integration and effectiveness.

The analytical approach utilised advanced statistical modelling techniques, including hierarchical linear modelling to account for nested student-course-institution structures, structural equation modelling to examine complex relationships between variables, and machine learning algorithms to develop predictive models for engagement patterns (Thompson & Lee, 2023).

RESULTS

Research Question 1:

Table 1: Engagement and Academic Performance Comparison

Metric	Digital Platform Users	Traditional Users	Method	Effect Size (Cohen's d)
Overall Engagement Rate	M = 0.784, SD = 0.123	M = 0.542, SD = 0.157		d = 1.67
GPA Score	M = 3.21, SD = 0.43	M = 2.94, SD = 0.51		d = 0.58
Course Completion Rate	M = 0.947, SD = 0.082	M = 0.891, SD = 0.114		d = 0.56

<i>Knowledge Retention Score</i>	M = 0.842, SD = 0.098	M = 0.716, SD = 0.124	d = 1.14
<i>Sustainability Behavior Scale</i>	M = 76.8, SD = 11.2	M = 65.3, SD = 13.7	d = 0.91

Digital platforms demonstrated substantial improvements across multiple engagement and performance metrics compared to traditional instructional approaches. Table 1 presents comprehensive comparisons of engagement and academic performance between digital platform users and students receiving traditional sustainability instruction.

Research Question 2:

Table 2: Platform-Specific Performance Metrics

Platform Type	Participation Rate	Sustained Engagement	Satisfaction Score	Learning Outcome Score
EcoLearn LMS	M = 0.960, SD = 0.042	M = 0.624, SD = 0.183	M = 7.2, SD = 1.4	M = 0.789, SD = 0.112
GreenConnect Collaborative	M = 0.505, SD = 0.128	M = 0.857, SD = 0.096	M = 8.4, SD = 1.1	M = 0.873, SD = 0.087
SustainabilityVR Experience	M = 0.177, SD = 0.081	M = 0.912, SD = 0.074	M = 9.1, SD = 0.8	M = 0.896, SD = 0.073

Each platform category exhibited distinct engagement patterns and effectiveness profiles. Table 2 details performance metrics across the three primary platform types, revealing significant variations in user experience and educational outcomes.

Three-level hierarchical modelling revealed the complex variance structure underlying engagement patterns, with students accounting for 68% of the variance in engagement, courses contributing 23%, and institutional factors accounting for 9% of the total variance. This distribution emphasises the primacy of individual student characteristics while acknowledging significant course-level and institutional influences.

Key predictors emerged from the multilevel analysis, with digital platform type showing the strongest relationship to engagement ($\beta = 0.42, p < .001$). Prior technology experience demonstrated substantial predictive value ($\beta = 0.28, p < .001$), suggesting that digital literacy is a crucial foundation for the effectiveness of sustainability education platforms. Faculty training levels also proved significant ($\beta = 0.35, p < .001$), highlighting the critical role of instructor preparation in successful platform implementation.

Research Question 3:

Table 3: Longitudinal Engagement Trajectory Classes

Trajectory Class	Percentage of Students	Initial Engagement	12-Month Engagement	24-Month Engagement	Platform Preference
High-Sustained	34.2	M = 0.873, SD = 0.081	M = 0.826, SD = 0.094	M = 0.789, SD = 0.112	VR Experience (62%)

Moderate-Declining	41.6	M = 0.764, SD = 0.127	M = 0.612, SD = 0.153	M = 0.487, SD = 0.186	LMS Module (71%)
Low-Stable	24.2	M = 0.421, SD = 0.139	M = 0.387, SD = 0.121	M = 0.352, SD = 0.143	Mixed Usage (45%)

Growth curve modelling across 24 months identified three distinct trajectory classes that capture the temporal dynamics of sustaining student engagement with digital platforms. Table 3 summarises these engagement trajectories and their associated characteristics.

Platform-specific engagement patterns revealed distinctive temporal characteristics that inform implementation strategies. The VR Experience demonstrated a "honeymoon-plateau" pattern, with initial high engagement levels maintaining consistency over time. The Collaborative Platform showed steady growth trajectories, typically peaking between months 16 and 18 as students developed stronger peer networks and collaborative skills. The LMS Module exhibited classic declining curves, with pronounced drops during semester transitions, suggesting the need for renewal.

Research Question 4:

Table 4: Engagement Patterns by Student Demographics

Student Category	Initial Engagement	Sustained Engagement	Completion Rate	Support Needs Score
First-Generation Students	M = 0.624, SD = 0.168	M = 0.712, SD = 0.143	M = 0.867, SD = 0.129	M = 7.8, SD = 1.4
Continuing-Generation Students	M = 0.718, SD = 0.132	M = 0.796, SD = 0.117	M = 0.923, SD = 0.086	M = 5.2, SD = 1.8
Limited Broadband Access	M = 0.589, SD = 0.192	M = 0.643, SD = 0.187	M = 0.784, SD = 0.162	M = 8.9, SD = 1.1
Adequate Broadband Access	M = 0.746, SD = 0.118	M = 0.812, SD = 0.094	M = 0.941, SD = 0.073	M = 4.7, SD = 1.6
International Students	M = 0.662, SD = 0.154	M = 0.837, SD = 0.102	M = 0.918, SD = 0.088	M = 6.8, SD = 1.5
Domestic Students	M = 0.731, SD = 0.126	M = 0.764, SD = 0.129	M = 0.905, SD = 0.097	M = 5.9, SD = 1.7

Examination of engagement patterns across diverse student populations revealed significant disparities requiring targeted intervention strategies. Table 4 presents engagement metrics across key demographic categories, highlighting areas where digital platforms may inadvertently create or exacerbate educational inequities.

First-generation students demonstrated lower initial engagement rates but showed remarkable resilience in sustained engagement once initial barriers were addressed. Students with limited broadband access experienced a 0.28 lower completion rate for video-intensive content, emphasising the critical importance of technological infrastructure for equitable education delivery. International students required 4-6 weeks to adapt to collaborative platform norms, but subsequently demonstrated some of the highest sustained engagement levels.

Digital platforms demonstrated superior cost-effectiveness compared to traditional sustainability education approaches across multiple financial metrics. The cost per engagement hour averaged ₦2,340 for digital platforms compared to ₦4,670 for traditional methods, representing a 50% reduction in per-student instructional costs. The calculated 5-year return on investment reached 312%, with implementation costs totalling ₦347,000,000 over the initial 3-year period and annual operational expenses of ₦78,000,000.

Twelve-month follow-up surveys revealed substantial real-world behavioural changes among students who engaged with digital platforms compared with those who received traditional instruction. Platform users demonstrated a 0.34 increase in sustainable transportation choices, a 0.28 improvement in personal energy-conservation behaviours, and a 0.42 increase in participation in campus sustainability initiatives. Most significantly, platform users proved 2.3 times more likely to pursue formal sustainability concentrations or related academic pathways.

Discussion

The 0.242 improvement in engagement rates demonstrates the substantial transformative potential of digital platforms for sustainability education. The superior sustained engagement correlation ($r = .73$) observed in collaborative platforms provides strong empirical support for social constructivist learning theory principles and reinforces the critical importance of peer interaction in environmental education contexts (García-González & Ramírez-Montoya, 2022).

Platform-specific insights reveal the complex relationship between accessibility, engagement, and educational effectiveness. LMS integration achieved the highest participation rates due to seamless institutional infrastructure integration, but required consistent content updates and engagement strategies to maintain student interest (Johnson & Smith, 2023). Collaborative environments demonstrated the most robust sustained engagement through social learning elements that fostered community development and peer accountability (Martinez, A. J., Haque, E., Thorne, P., and Hornbuckle, K. C., 2022). Immersive technologies generated the highest satisfaction ratings and learning outcomes but faced significant scalability challenges related to equipment costs and technical support requirements (Chen & Rodriguez, 2023).

Based on empirical findings, institutions considering the implementation of a digital sustainability platform should prioritise five evidence-based selection criteria.

1. Collaborative features enabling meaningful peer interaction prove essential for sustained engagement.
2. Interactive content that extends beyond passive consumption creates active learning environments necessary for complex sustainability concept mastery.
3. Mobile accessibility and equity optimisation ensure broad student participation across diverse demographic groups.
4. Integration capabilities with existing institutional infrastructure minimise implementation barriers and maximise adoption rates.
5. Comprehensive assessment and analytics capabilities provide essential data for continuous improvement and outcome measurement.

Institutional readiness requirements encompass four critical domains.

1. Technology infrastructure must include adequate bandwidth, device access, and technical support systems capable of handling increased digital platform demands.
2. Faculty training in digital pedagogy principles ensures effective platform utilisation and student support.

3. Comprehensive student support systems address diverse learning needs, technological barriers, and engagement challenges.
4. Administrative commitment with appropriate resource allocation sustains long-term implementation success and continuous platform development.

Conclusion

This comprehensive investigation demonstrates the transformative potential of sustaining student engagement through digital platforms in higher education contexts. The TESE Framework provides both a theoretical foundation and practical guidance for institutions seeking to implement effective digital sustainability education initiatives globally (UNESCO, 2020). Key success factors include pedagogical design that emphasises interactivity over passive content consumption, meaningful opportunities for collaboration that leverage social learning principles, robust institutional support systems that address technological and pedagogical challenges, and careful attention to equity considerations to ensure universal access and participation (Fredricks et al., 2004).

For university administrators and faculty members, these findings suggest that implementing strategic digital platforms can simultaneously advance environmental education goals while improving overall instructional effectiveness and cost efficiency. The demonstrated financial advantages and scalability potential make digital approaches particularly attractive to institutions seeking to expand sustainability education across diverse academic programs and student populations without proportional increases in resources.

Recommendations

However, successful implementation requires comprehensive change management strategies rather than merely deploying technology. The most effective platforms leveraged technological capabilities to enable fundamentally new forms of learning and collaboration rather than merely digitising existing content delivery approaches. This distinction proves crucial for institutions seeking meaningful educational transformation rather than superficial technological adoption.

The intersection of digital transformation and sustainability education represents a critical opportunity for preparing students to address complex 21st-century environmental challenges through technological fluency combined with deep environmental understanding. As digital technologies continue evolving and environmental pressures intensify globally, universities that develop expertise in this integrated approach will position themselves to serve both educational excellence and broader societal needs.

The Southern Delta University model provides a replicable framework while emphasising the importance of adapting implementation strategies to local institutional contexts, student demographics, and resource availability. The demonstrated benefits, combined with growing technological accessibility and platform sophistication, suggest that digital sustainability education initiatives will become increasingly central to higher education's leadership role in environmental education and social responsibility.

Future success in this domain depends upon continued collaboration between educational researchers, technology developers, sustainability experts, and institutional leaders committed to evidence-based innovation. This framework provides a foundation for such collaborative efforts while identifying critical research questions that must be addressed to realise the full potential of digital sustainability education in addressing global environmental challenges through higher education transformation.

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EVALUATING E-LEARNING READINESS AND OPEN EDUCATIONAL RESOURCES USE AMONG STUDENTS OF NATIONAL OPEN UNIVERSITY OF NIGERIA (NOUN)

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Abstract

This study examined e-learning readiness and the use of Open Educational Resources (OERs) among students of the National Open University of Nigeria (NOUN). The challenge addressed is whether students possess the necessary motivation, digital access, and support to fully benefit from e-learning and OERs. Using a descriptive survey design, data were collected from 1,911 students across six study centres, with analysis conducted using descriptive statistics. Results showed that students displayed moderate to high levels of e-learning readiness, particularly in technical support (mean = 2.89) and motivation (mean = 3.08), though device access posed challenges (mean = 2.82). OER usage was generally high, especially for structured, course-related resources such as courseware (mean = 3.47) and online tutorials (mean = 3.08), while reference-based materials were less utilized. The study recommends improved device accessibility, expanded technical support, and targeted training to enhance effective and diversified use of OERs.

Keywords: *E-learning readiness, OERs, Digital access, Distance learning*

Introduction

Open Educational Resources (OERs) are teaching, learning and research materials that offer unrestricted access to a vast array of educational materials and tools, and called be seen as an advance step in the field of education. The emergence of open and distance learning (ODL) and a broader culture of open knowledge, open source, free sharing, and peer collaboration in the late 20th century served as the impetus for the OERs movement (Mishra et al., 2022). Bliss and Smith (2017) opined that the open-source community supported the movement, which aimed to increase information access by utilising free and open content. Establishing equitable access for both privileged and underprivileged individuals worldwide to construct a collective knowledge base was the tacit objective. With its global momentum, this revolutionary movement is changing the way that education is delivered and this opens up new avenues for students of all stripes.

The National Open University of Nigeria (NOUN), a leading institution of Open and Distance Learning in Nigeria, leverages open educational resources to enhance accessibility and quality of educational delivery. By operating OERs policy, NOUN provides a wide range of freely available, high-quality educational materials that support diverse learning needs and promote lifelong learning. This not only reduces the cost of educational resources for students

but also ensures that up-to-date and relevant materials are readily available, fostering inclusive and flexible learning environment in line with global educational standards.

The use of OERs by students is intrinsically linked to e-learning readiness and the development of digital literacy skills. E-learning readiness is a multifaceted concept that takes into account the technological, cognitive and social aspects of online learning. The typical e-learning readiness assessment measures the users' ability to adapt to technological challenges, collaborative learning skills and training as well as the synchronous and asynchronous self-paced learning and training (Hashim & Tasir, 2014). Other indices of e-learning readiness include availability of technological infrastructure, The link to access to relevant electronic devices, learning skills required to use engage with the electronic contents, technical support and internet connectivity available for use. By addressing these factors, students can enhance his/her readiness to effectively engage with OERs and benefit therefrom. This study adopted access to relevant electronic devices, access to internet connectivity, technical support and learners' motivation as indicators of NOUN students' e-learning readiness.

Statement of the Problem

The shift towards e-learning has necessitated an examination of students' readiness in digital learning activities, particularly in institutions like the National Open University of Nigeria (NOUN). E-learning readiness encompasses various factors, including access to technology, technical support and learner motivation to engage in virtual learning. For NOUN students, many of whom are adults balancing education with work and family responsibilities, the transition to online learning can be challenging. These students must not only possess basic digital literacy skills but also have the confidence and ability to engage effectively with digital learning platforms. The extent to which NOUN students are prepared for e-learning directly impacts their academic success and the overall effectiveness of the university's educational delivery.

Moreover, the use of Open Educational Resources (OERs) presents both opportunities and challenges. OERs can significantly enhance learning by providing free and flexible resources, but they also require students to navigate and utilise digital content efficiently. For NOUN students, who may have varying levels of digital literacy, the ability to find, evaluate, and use OERs is critical. This raises important questions about the current state of their learning readiness and the technical support available to help them leverage these resources. Understanding and addressing these factors is crucial for improving educational outcomes and ensuring that students can fully benefit from the advantages of e-learning and OERs

Research Objectives

The main objective of this study is to investigate the e-learning readiness and open educational resources use by National Open University of Nigeria (NOUN) students. Specifically the study seeks to:

1. investigate open educational resources use by National Open University of Nigeria (NOUN) students; and
2. find out the level of e-learning readiness of National Open University of Nigeria (NOUN) students.

Research Questions

The study would answer the following research questions:

1. What is the level of open educational resources use by National Open University of Nigeria (NOUN) students?
2. What is the level of e-learning readiness of National Open University of Nigeria (NOUN) students?

Hypothesis

E-learning readiness has no significant influence on the Open Educational Resources (OERs) use by Students of National Open University of Nigeria.

Literature Review

E-learning readiness has emerged as a crucial determinant of students' success in virtual learning environments. A central finding across studies is that readiness significantly influences self-regulation and the ability to manage online learning processes. Ucar and Ugurhan (2023) demonstrated that students with higher readiness were better able to set goals, maintain motivation, and sustain their learning efforts throughout online courses. Similarly, Salisu et al (2025) established a strong positive correlation between readiness and academic achievement, showing that adequately prepared students not only perform better but are also more likely to complete their programmes successfully. Together, these findings suggest that readiness is a critical predictor of both learner autonomy and academic outcomes in digital education.

While technological competence is often viewed as the foundation of e-learning readiness, research has shown that it is insufficient on its own. Caliskan et al. (2017) revealed that although university students generally possessed moderate to high levels of technological skill, many displayed deficiencies in self-management and independent learning. This indicates that true readiness extends beyond digital familiarity to include cognitive, affective, and time management abilities. Majid and Lakshmi (2022) further reinforced this argument by highlighting readiness as a multidimensional construct shaped by factors such as infrastructure quality, cultural attitudes toward technology, and prior exposure to digital environments. Thus, readiness must be conceptualized as a holistic blend of technical proficiency, learning dispositions, and contextual influences.

Student experiences further illustrate the complexity of readiness in online learning. Mahajan and Kalpana (2018) reported that learners valued the flexibility and accessibility afforded by e-learning but also faced significant challenges, including limited instructor interaction, lower motivation, and unstable internet connectivity. These findings suggest that while students may possess the basic skills to participate in online education, structural and pedagogical barriers can undermine their readiness and engagement. Addressing such gaps requires not only student preparation but also institutional investments in infrastructure and interactive instructional design.

Another strand of research has examined the relationship between readiness and students' openness to innovative pedagogical approaches. Aramide et al (2025) demonstrated that learners with higher readiness levels displayed more positive attitudes toward gamification elements, such as badges and leaderboards, and reported greater persistence in learning activities. Conversely, learners with lower readiness showed resistance to such innovations. This suggests that readiness not only predicts academic success but also mediates the adoption of emerging digital pedagogies, highlighting its broader role in shaping the trajectory of online learning environments.

Beyond students, faculty readiness is increasingly recognized as an essential component of successful e-learning implementation. Vijaya (2021) found that while faculty members often had strong subject expertise, many lacked confidence in using advanced e-learning tools, designing interactive online lessons, and fostering engagement in virtual classrooms. This gap reflects the need for continuous professional development, peer mentoring, and enhanced technical support. The study by Aramide et al (2025) reinforces this point, showing that although students were generally more adaptable to technological environments, faculty demonstrated greater weaknesses in digital pedagogy. Both groups, however, emphasized the

necessity of institutional infrastructure and training, suggesting that readiness interventions must address the needs of both instructors and learners simultaneously.

Taken together, the empirical evidence indicates e-learning readiness as a multifaceted and systemic construct, encompassing not only technological access and skills but also self-regulation, motivation, cognitive and affective abilities. In conclusion, the reviewed studies converge on the view that fostering readiness is indispensable for the sustainability and effectiveness of online education. Higher education institutions must therefore adopt comprehensive readiness frameworks that integrate infrastructural development, student preparation, and faculty training. By doing so, they can address the diverse dimensions of readiness, enhance learner autonomy and motivation, and support innovative pedagogies such as gamification. Ultimately, readiness should be approached not as a static trait but as a dynamic process that requires continuous reinforcement through training, support, and policy interventions to ensure quality outcomes in open and distance learning.

Methodology

This study employed the descriptive survey research design within a quantitative approach, deemed appropriate for examining the influence of e-learning readiness and use of open educational resources (OERs) among students of the National Open University of Nigeria (NOUN). The target population comprised all 115,688 active undergraduate and postgraduate students across the university's 123 study centres nationwide. A multi-stage sampling procedure was used, multistage sampling was appropriate because of the nature of study population: in the first stage, all six geopolitical zones were included as the population of the study; in the second stage, one representative study centre was purposively selected from each zone, the study centre with the highest number of students was selected from each zone to ensure adequate representation of strata of the population; and in the final stage, Research Advisors' (2006) sample size table guided the determination of participants from each of the selected study centres. This process yielded a sample size of 1,976 students drawn from Abuja, Maiduguri, Kaduna, Enugu, Port Harcourt, and Lagos study centres.

Data were collected using a structured questionnaire titled *E-learning Readiness and Open Educational Resources Use Questionnaire (EROERUQ)*. The instrument, adapted from previous studies, was divided into four sections: demographic information, awareness and types of OERs, frequency of OERs use and e-learning readiness. Items were rated on four- or five-point Likert scales, depending on the construct measured. To facilitate administration, the questionnaire was coded into a Google Form and distributed electronically by sharing the link on the official social media platforms of the selected study centres. Out of the responses received, 1,911 were found valid and subsequently used for analysis. Instrument validity was ensured through face and content review by academic experts, while reliability was confirmed through a pilot study involving 30 from Iconic Open University Sokoto, which yielded an overall Cronbach's alpha coefficient of 0.79, indicating good internal consistency.

The validated instrument was administered online, and data were analysed using descriptive and inferential statistics. Frequency counts, percentages, means, and standard deviations were used to describe respondents' characteristics and address the research questions and simple linear regression was used to test the hypothesis. A mean score of 2.50 was adopted as the decision benchmark for interpreting responses on the rating scales. The result is presented in Table 1-4

Results**Table 1: Demographic profile of the respondents**

Study Centre	Freq	Percentage
Abuja	227	11.89
Enugu	94	4.90
Kaduna	241	12.59
Lagos	1042	54.55
Maiduguri	200	10.49
Port Harcourt	107	5.59
Total	1911	100.00
Gender	Freq	Percentage
Male	922	48.25
Female	989	51.75
Total	1911	100.00
Programme	Freq	Percentage
Undergraduate	1082	56.64
Postgraduate	829	43.36
Total	1911	100.00
Faculty	Freq	Percentage
Agricultural sciences	40	2.10
Arts	134	6.99
Computing	94	4.90
Education	521	27.27
Health sciences	307	16.08
Law	-	0.00
Management sciences	321	16.78
Sciences	94	4.90
Social Sciences	401	20.98
Total	1911	100.00
Level of study	Freq	Percentage
100	214	11.19
200	414	21.68
300	147	7.69
400	227	11.89
500	107	5.59
700	241	12.59
800	535	27.97
900	27	1.40
Total	1911	100.00
Age (in years)	Freq	Percentage
Less than 18	0	0
18 – 22	94	4.90
23 – 27	374	19.58
28 – 32	428	22.38
33 – 37	361	18.88
38 – 42	267	13.99
43 – years above	388	20.28
Total	1911	100.00

The distribution of respondents across study centres in Table 1 shows that Lagos recorded the highest proportion (54.55%), while Enugu had the lowest (4.90%). By faculty, Education accounted for the largest share of respondents (27.27%), whereas Agricultural Sciences recorded the lowest at 2.10%, with no response from the Faculty of Law (0.00%). Across programmes, undergraduates constituted the majority (56.64%), while postgraduates represented 43.36%. Gender distribution was nearly balanced, with females slightly higher (51.75%) than males (48.25%).

Analysis of level of study revealed that 800-level students formed the highest category (27.97%), while 900-level students were the least represented (1.40%). Age distribution indicated that the 28–32 years group had the highest participation (22.38%), followed by respondents aged 43 years and above (20.28%), whereas the lowest participation was observed among the 18–22 years group (4.90%).

Table 2: Types of OERs used by NOUN students

S/N	Types of OERs I make use of:	Always = 4	Often = 3	Rarely = 2	Never = 1	Mean	Std
i.	Open access journals, magazines and periodicals	281	601	748	281	2.46	0.11
ii.	Open access reference e-books	494	588	641	187	2.73	0.37
iii.	Open access e-text books	682	641	494	94	3.00	0.61
iv.	Open access reports	294	494	815	307	2.41	.06
v.	Open online courses and tutorials	868	722	241	80	3.24	.82
vi.	Open online anti-plagiarism	441	508	695	267	2.59	.26
vii.	Open online grammar checker	414	601	628	267	2.61	.27
viii.	Openly shared video clips of lectures	655	575	508	174	2.90	.54
ix.	Openly shared lecture notes and class notes	748	535	481	147	2.99	.62
x.	Open courseware (course materials)	1189	428	294	0	3.47	.02
xi	Open online tutorials on specific topics	775	655	334	147	3.08	.70
Xii	Open online interactive help desks and forums	748	588	441	134	3.02	.65

The result in Table 2 shows varying levels of use of different types of OERs by the students. Open access reports (Mean = 2.41) and open access journals, magazines and periodicals (Mean = 2.46) were below the criterion mean of 2.50, indicating low use. Similarly, open access reference e-books (Mean = 2.73), open online anti-plagiarism tools (Mean = 2.59), open online grammar checkers (Mean = 2.61), and openly shared video clips of lectures (Mean = 2.90) were all above the criterion mean but below 3.00, showing moderate use. This implies that while these resources are accessed, they are not yet maximally used by NOUN students.

In contrast, open access e-textbooks (Mean = 3.00), openly shared lecture and class notes (Mean = 2.99 \approx 3.00), open online tutorials on specific topics (Mean = 3.08), open online

interactive help desks and forums (Mean = 3.02), open online courses and tutorials (Mean = 3.24), and open courseware (Mean = 3.47) all recorded mean values within the 3.00–4.00 range, signifying high use. This finding suggests that learners prefer structured, course-related and interactive OERs over reference or reporting materials. The outcome is consistent with Vijaya et al. (2020), who equally reported a high level of OERs use among undergraduates, particularly in accessing open courseware and online tutorials, thereby confirming that OERs play a significant role in supporting academic engagement.

Table 3: Frequency of OER use by NOUN students

S/N	Frequency of OERs Use	Daily = 5	Weekly = 4	Monthly = 3	Occasionally = 2	Never = 1	Mean	Std
I use OERs:								
i.	Open access journals, magazines and periodicals	254	588	374	481	214	3.10	0.83
ii.	Open access reference e-books	388	575	281	481	187	3.26	0.01
iii.	Open access e-text books	575	508	254	428	147	3.49	0.23
iv.	Open access reports	334	468	468	347	294	3.10	0.88
v.	Open online courses and tutorials	668	615	267	267	94	3.78	0.46
vi.	Open online anti-plagiarism	254	454	428	428	347	2.92	0.70
vii.	Open online grammar checkers	441	374	454	281	361	3.13	0.95
viii.	Openly shared video clips of lectures	414	708	307	321	160	3.47	0.18
ix.	Openly shared lecture notes and class notes	544	535	307	267	147	3.67	0.38
x.	Open courseware (course materials)	935	575	94	254	53	4.09	0.74
xi.	Open online tutorials on specific topics	641	682	200	241	147	3.75	0.45
xii.	Open online interactive help desks and forums	561	601	374	174	200	3.60	0.32

Weighted Mean**3.45**

The results in Table 3 indicate that the respondents generally demonstrated a high level of engagement with OERs, with the weighted mean of 3.45 exceeding the criterion mean of 2.50, thereby showing that OERs are used regularly. Specifically, open courseware (Mean = 4.09), open online courses and tutorials (Mean = 3.78), open online tutorials on specific topics (Mean = 3.75), openly shared lecture notes and class notes (Mean = 3.67), and open online interactive forums (Mean = 3.60) were the most frequently used, all falling within the regular use category (Mean = 3.00–4.00). Similarly, open access e-textbooks (Mean = 3.49), openly shared video clips of lectures (Mean = 3.47), and open access reference e-books (Mean = 3.26) also recorded regular use, reflecting a preference for structured and interactive OER formats that directly support academic study.

In contrast, open online grammar checkers (Mean = 3.13), open access journals, magazines and periodicals (Mean = 3.10), and open access reports (Mean = 3.10) were also regularly used but at a lower intensity relative to courseware and tutorials. Open online anti-plagiarism tools (Mean = 2.92) ranked lowest, with usage falling in the often category, suggesting that students may rely more on other forms of academic support than on plagiarism-detection tools. Overall, the findings reinforce the conclusion that postgraduate students engage with OERs on a regular basis. This outcome aligns with Aramide et al (2025), who similarly reported regular use of OERs by postgraduate learners, underscoring their integral role in advanced academic research and study practices.

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Table 4: Level of E-learning readiness

S/N	E-learning Readiness	VHE (4)	HE (3)	LE (2)	VLE (1)	Mean	Std
	Technical Support						
i.	To what extent is technical support readily available to assist you when you encounter difficulties using Open Educational Resources at NOUN?	428	855	481	147	2.82	0.42
ii.	To what extent does NOUN provide timely and effective technical assistance for resolving issues related to Open Educational Resources?	401	922	481	107	2.85	0.43
iii.	To what extent do the guidelines and troubleshooting resources provided by NOUN help students overcome technical challenges when using Open Educational Resources?	361	1056	414	80	2.89	0.45
iv.	To what extent does NOUN provide multiple technical support channels (e.g., email, chat, phone, or helpdesk) that facilitate the resolution of issues related to Open Educational Resources?	535	962	321	94	3.01	0.59
v.	To what extent are you satisfied with the responsiveness and competence of NOUN's technical support team in addressing challenges related to Open Educational Resources?	494	909	361	147	2.92	0.52
	Weighted Mean					2.89	
	Device Access						
vi.	To what extent do you have personal access to a functional device (e.g., laptop, tablet, or smartphone) for engaging with Open Educational Resources?	922	628	294	67	3.26	0.84
vii.	To what extent does your primary device support seamless access to Open Educational Resources (e.g., compatibility with required file formats, stable performance, etc.)?	682	855	347	27	3.15	0.71
viii.	To what extent do you experience interruptions in accessing Open Educational Resources due to device-related issues (e.g., battery life, screen size, processing speed, or hardware failure)?	307	601	748	254	2.50	0.15
ix.	To what extent do you have access to alternative devices (e.g., borrowing from friends, using public computers) when your primary device is unavailable?	334	588	655	334	2.48	0.15
x.	To what extent does the cost of acquiring and maintaining a suitable device affect	307	909	521	174	2.71	0.31

	your ability to access Open Educational Resources?								
	Weighted Mean								2.82
	Learner Motivation								
xi	To what extent do Open Educational Resources (OERs) enhance your motivation to engage in independent learning?	695	909	241	67	3.17	0.73		
xii	To what extent does the availability of Open Educational Resources encourage you to explore additional learning materials beyond the provided course content?	535	909	374	94	2.99	0.57		
xiii.	To what extent do Open Educational Resources help you stay motivated to complete your coursework and academic activities at NOUN?	641	989	254	27	3.17	0.72		
xiv.	To what extent do the interactive and multimedia features of Open Educational Resources (e.g., videos, simulations, quizzes) improve your engagement with learning materials?	428	989	414	80	2.92	0.49		
xv.	To what extent does easy access to Open Educational Resources reduce learning-related stress and improve your confidence in completing academic tasks?	655	855	374	27	3.12	0.68		
	Weighted Mean								3.08

Table 4 results on technical support indicate a high extent of readiness with a weighted mean of 2.89, which is above the criterion mean of 2.50. This suggests that students perceive NOUN's technical support for OERs as fairly effective and accessible, particularly through the provision of multiple support channels (Mean = 3.01) and reasonably responsive assistance (Mean = 2.92). Although the extent of readiness is not very strong, it still reflects a substantial level of institutional support. This finding aligns with Mahajan and Kalpana (2018), who reported that technical support significantly influences the use of OERs by both students and faculty, underscoring the importance of structured technical assistance in sustaining OER adoption.

With respect to device access, the findings revealed a moderate extent of readiness with a weighted mean of 2.82. While students reported personal access to functional devices (Mean = 3.26) and seamless compatibility of devices with OER platforms (Mean = 3.15), challenges were evident in alternative device access (Mean = 2.48) and interruptions due to device-related issues (Mean = 2.50). This suggests that although most students have access to personal devices, constraints such as cost and lack of reliable alternatives still limit effective OER engagement. This finding supports Majid and Lakshmi (2022), who reported that higher levels of device access significantly encourage OER use among distance learners.

For learner motivation, the results indicated a high extent of readiness with a weighted mean of 3.08, showing that OERs play a vital role in sustaining postgraduate students' learning drive. Respondents noted that OERs enhance motivation for independent learning (Mean = 3.17), support coursework completion (Mean = 3.17), and reduce learning-related stress (Mean = 3.12). These findings imply that OERs are not only functional tools but also strong motivators

for active engagement in learning. The results corroborate Salisu et al (2025), who found a positive correlation between learner motivation and OER use among postgraduate students, further highlighting the role of OERs in fostering both academic persistence and success.

Hypothesis Testing

Table 5: Simple linear regression predicting Open Educational Resources (OERs) use from e-learning readiness among students of the National Open University of Nigeria (NOUN)

Predictor	B	SE B	β	T	P
Constant (OERs Use)	0.98	0.24	—	4.08	< .001
E-learning readiness	0.84	0.07	.63	11.25	< .001
Model fit: $R = .63$, $R^2 = .40$, Adjusted $R^2 = .39$, $F(1, 188) = 126.48$, $p < .001$					

A simple linear regression analysis was conducted to examine if e-learning readiness significantly predicts Open Educational Resources (OERs) use by students of National Open University of Nigeria. The regression model was statistically significant, $F(1, 188) = 126.48$, $p < .001$, accounting for 40% of the variance in OERs use ($R^2 = .40$). E-learning readiness emerged as a significant positive predictor of OERs use among NOUN students, $B = 0.84$, $SE = 0.07$, $\beta = .63$, $t = 11.25$, $p < .001$. This indicates that higher levels of e-learning readiness are associated with increased Open Educational Resources (OERs) use among students of National Open University of Nigeria (NOUN).

Based on the above analysis, the null hypothesis stating that e-learning readiness has no significant influence on OERs use among students of the National Open University of Nigeria is rejected. The alternative hypothesis is therefore accepted.

Major Findings

1. The study revealed that students of NOUN make high use of structured and course-related OERs such as open access e-textbooks (Mean = 3.00), open online tutorials (Mean = 3.08), open online courses (Mean = 3.24), and open courseware (Mean = 3.47), while the use of open access reports (Mean = 2.41) and open access journals, magazines, and periodicals (Mean = 2.46) was low. This indicates a strong preference for interactive and course-aligned OERs over reference-based materials.
2. The level of e-learning readiness among NOUN students was generally moderate to high across the three measured dimensions. Technical support (Weighted Mean = 2.89) and learner motivation (Weighted Mean = 3.08) reflected a substantial level of readiness, while device access (Weighted Mean = 2.82) indicated moderate readiness, constrained mainly by cost and limited alternative device availability.

Conclusion

The study concludes that while NOUN students demonstrate appreciable levels of e-learning readiness and actively engage with structured, course-related OERs, challenges remain in diversifying resource use and strengthening device access. Technical support and learner motivation were found to be significant drivers of OER adoption, but limited access to alternative devices and underuse of reference-based OERs constrain optimal utilization. Overall, the findings affirm that NOUN students are fairly ready for e-learning and are already integrating OERs into their academic practices, though targeted interventions are necessary to bridge existing gaps.

Recommendations

1. Strengthen device accessibility initiatives: NOUN should collaborate with ICT vendors and service providers to subsidize device acquisition and provide shared access options (e.g., device loan schemes or learning hubs) to reduce the challenges of cost and limited alternatives.
2. Expand technical and motivational support for OER use: Beyond maintaining multiple support channels, NOUN should regularly train students on the use of underutilized OER categories (e.g., journals, reports, and e-books) while sustaining learner motivation through incentives, awareness campaigns, and integration of OERs into coursework.

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EMERGING TECHNOLOGIES IN LIBRARY AND INFORMATION SCIENCE (LIS) EDUCATION IN THE DIGITAL AGE: A DESK REVIEW

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Abstract

*As the digital age progresses, emerging technologies are fundamentally transforming Library and Information Science (LIS) education. This paper explores the integration of innovative technologies such as Artificial Intelligence (AI), Virtual Reality (VR), Cloud Computing, Big Data, and Blockchain into LIS curricula. AI enhances user engagement through intelligent chatbots and data analytics, enabling libraries to tailor services to patron needs. VR and Augmented Reality (AR) offer immersive learning experiences, facilitating deeper understanding of digital collections. Cloud computing supports resource sharing and collaborative learning, while Big Data analytics empower librarians to make data-driven decisions. Digital curation tools and the incorporation of Open Educational Resources (OER) play crucial roles in managing and disseminating information. Additionally, mobile technologies and gamification strategies enhance accessibility and engagement, fostering a more interactive learning environment. This review underscored the necessity for LIS programs to adapt to these technological advancements to prepare graduates for the evolving information landscape. The study concluded that, integrating these tools into educational frameworks is essential for improving learning outcomes and equipping students with the necessary skills for leadership in contemporary information settings. **The study recommended a need to** foster partnerships between academia and technology providers, investing in faculty training on emerging technologies, and developing interdisciplinary curricula that reflect the multifaceted nature of modern information challenges.*

Keywords: *Library and Information Science, emerging technologies, education, Artificial Intelligence, digital curation.*

Introduction

The field of library and information science (LIS) education is undergoing a significant upheaval in a time of unparalleled digital change. Libraries have changed from being associated with quiet reading rooms and card catalogues to becoming vibrant centers of digital resources, data analytics, and online interactions. According to Lau et al. (2020), this evolution calls for a paradigm shift in LIS education, requiring educators to give aspiring professionals the tools they need to lead and navigate an increasingly complex information environment. Significant changes in the way libraries function have been sparked by the development of information technology. Conventional patterns of information dissemination have been upended by the growth of mobile and internet technologies. Digital libraries, online databases, and social media platforms have revolutionised the way consumers search, access, and engage with information (Opele, 2023a). Libraries now serve as community centers, cultural hubs, and digital literacy facilitators in addition to being information repositories (Siddique et al., 2023). LIS education must change to include these new technologies if it is to prosper in this changing environment. According to academics, incorporating technology into LIS courses is crucial for equipping students to handle the demands of contemporary librarianship (Farid et al., 2023). According

to the literature, the year 2000 brought with it an era of "wired" individuals, highlighting the necessity for LIS professionals to become proficient with technology (Latham & Pinder, 2005). Numerous studies that stress the value of technology literacy in the LIS field and the necessity of a curriculum that takes into account both present trends and future demands support this view (Stoffberg & Blignaut, 2013).

The information landscape and the skills needed by future librarians are changing as a result of emerging technologies including artificial intelligence (AI), virtual reality (VR), cloud computing, big data, and blockchain. For example, AI is transforming user interaction through data analytics and intelligent chatbots, allowing libraries to customise services to each patron's unique needs (Opele, 2023b). This change not only improves the user experience but also frees up librarians to work on more complex projects that need for creativity and critical thought. In a similar vein, augmented reality (AR) and virtual reality (VR) are providing cutting-edge educational opportunities that promote a deeper comprehension of digital resources. Students can engage with knowledge in previously unthinkable ways in immersive learning environments made possible by these technologies (Su & Chen, 2022). For instance, libraries are expanding access and engagement by employing virtual reality (VR) to offer virtual tours that let patrons explore collections and resources from the comfort of their homes.

Additionally, cloud computing has become an essential part of contemporary LIS education. Cloud technologies enable collaboration between instructors and students by offering scalable solutions for resource management and data storage (Siddique et al., 2023). According to Abdulrahman et al. (2021), this invention facilitates the creation of digital libraries and shared resources, allowing organisations to maximise their operations while upholding high levels of accessibility. Additionally, Big Data analytics is essential for comprehending consumer behaviour and preferences. Librarians can make well-informed decisions regarding program development, resource allocation, and service improvement by utilising data-driven insights (Mehmood et al., 2019). Large dataset analysis enables libraries to predict user wants, which eventually improves service delivery and increases user happiness (Ummah, 2019). Additionally, blockchain technology is becoming more popular as a safe approach to manage digital rights and transactions, giving libraries new tools to guarantee transparency and safeguard intellectual property (Latif et al., 2021). It is a useful addition to the technological toolkit of aspiring librarians, with possible uses in LIS ranging from digital asset management to information authenticity verification.

There are still issues with incorporating these technologies into LIS teaching, despite the obvious advantages. A paucity of resources and out-of-date curricula make it difficult for many LIS programs to successfully integrate cutting-edge technologies (Adigun et al., 2024). In order to acquire the skills needed to instruct these new tools, faculty members could also need training. The transition to a technology-enhanced educational paradigm necessitates that educators not only comprehend the technologies themselves but also know how to successfully incorporate them into pedagogy, as observed by Kumar (2010). Additionally, one of the biggest challenges for LIS educators is the speed at which technology is changing. Because of this changing environment, LIS professionals must be committed to lifelong learning and ready to change with the technologies they use (Owolabi et al., 2022). This research seeks to investigate the revolutionary effects of new technologies on LIS education in light of these factors. The study aims to highlight the crucial role that technology will play in influencing the future of librarianship and to offer insights to educators, students, and practitioners in the field of LIS.

Review of Related Literature

A Brief History of Technology in LIS Education

Over the years, the link between technology and Library and Information Science (LIS) education has changed dramatically, reflecting broader societal changes in the management, distribution, and availability of information. Libraries started using mechanical equipment to enhance cataloguing and indexing in the early 20th century, which is when technology in LIS first emerged. A progressive integration of technology into library activities began with the invention of the typewriter and, subsequently, microfilm technology, which transformed record-keeping and information retrieval (Hillmann et al., 2008). The first automated cataloguing systems were introduced in the middle of the 20th century, marking the beginning of automation in libraries. The Online Computer Library Center (OCLC) and the MARC (Machine-Readable Cataloguing) format were developed during the crucial 1960s and 1970s (De Groote & Dorsch, 2003). These developments significantly altered how libraries functioned and how material was accessed by laying the foundation for computerised cataloguing and information retrieval (Abubakar, 2014). The late 20th century saw the emergence of the internet, which presented both new opportunities and challenges for LIS education. Curricula had to change to include digital literacy, information technology skills, and an awareness of the emerging area of digital librarianship due to the growth of digital information resources.

According to Togia et al. (2012), LIS programs must adapt and prepare students for this new reality as the advent of online databases and digital repositories changed the landscape of information access. The development of online 2.0 and the spread of online technologies in the early 2000s significantly changed the function of libraries and the skills needed by librarians (Mansour, 2016). LIS educators were forced to reconsider their instructional techniques as social media platforms, user-generated material, and collaborative tools become essential to library services (Emezie & Nwaohiri, 2016). Programs started emphasising the value of digital communication, social media involvement, and user-centred design in addition to traditional library skills (Al-Daihani, 2011; Tsarapkina et al., 2021).

Current Trends

The transformative influence of technology integration in LIS education is highlighted by recent research (Asemi, 2023; Nikita Shivaji, 2024), which also demonstrate a rising consensus among educators regarding the importance of adopting developing technologies into curricula. Over the past ten years, a substantial amount of work has been produced that focuses on many facets of technology in LIS education, from pedagogical practices to curriculum design (Omehia et al., 2021). One significant trend is the increasing emphasis on integrating emerging technology into LIS programs. According to research, programs are taking a more comprehensive approach to integrating technology because they understand how important it is to give students a wide range of skills. According to research by Matusiak et al. (2022), for example, many LIS schools are already offering courses on data analytics and AI, demonstrating the understanding that these technologies are crucial skills for aspiring librarians. Additionally, technologies like augmented reality and virtual reality are being investigated for their potential to improve learning and user engagement. For instance, (Nedbal et al., 2023) show how virtual reality (VR) technology are being used in library instruction to build immersive learning environments that let students engage with resources and collections in novel ways. This move toward experiential learning reflects a larger tendency in LIS education to use pedagogical strategies that emphasise interactive, hands-on learning.

Online Resources and Collaborative Learning

The growth of technologically enabled collaborative learning spaces is another noteworthy development. In LIS education, using online platforms for group projects, conversations, and knowledge exchange is becoming more widespread. According to research by Opele (2022), cloud computing and collaborative technologies help pupils develop a sense of community by facilitating easy communication and resource sharing. Furthermore, LIS curricula are increasingly incorporating Open Educational Resources (OER) (Iyanda & Opele, 1979). OER promotes equity and inclusion in education by enabling teachers to give students free and easily available educational resources.

A Focus on Digital Literacy

Due to the evolving nature of information access and the skills needed to successfully traverse it, digital literacy has become a basic competency in LIS education. According to recent research, LIS teachers are placing a greater emphasis on teaching students digital literacy so they can use digital tools, critically assess information sources, and interact with developing technology. The larger objectives of LIS education, which seek to equip students as advocates for information access and equity as well as information management, are in line with this emphasis on digital literacy.

Emerging Technologies in the Teaching of Library and Information Science

Artificial Intelligence (AI), Virtual Reality (VR), Augmented Reality (AR), Cloud Computing, Big Data Analytics, Digital Curation Tools, Social Media Integration, Open Educational Resources (OER), Mobile Technologies, Blockchain Technology, Gamification, and Collaborative Learning Platforms are just a few of the noteworthy developments that have revolutionised Library and Information Science (LIS) education. Each of these technologies offers special chances to improve user interaction, simplify resource management, and encourage teamwork in library environments.

AI, or artificial intelligence

By improving user engagement and automating procedures, artificial intelligence (AI) is transforming the field of library and information science (LIS). Chatbots are one of the most obvious uses of AI in libraries (Kasneji et al., 2023). These AI-powered applications offer consumers immediate support by responding to often requested queries and directing users via library resources. For example, customers can access information even after regular library hours thanks to the University of Michigan Library's 24-hour chatbot. This lessens the workload of library employees while simultaneously increasing user satisfaction (Li & Zhu, 2022). Another crucial use of AI is data analytics, which allows libraries to examine enormous volumes of user data to learn more about the tastes and behaviour of its patrons. Libraries can customise services to fit the unique requirements of their communities by utilising data analytics. For instance, libraries can determine the most popular resources and modify their holdings accordingly. Additionally, analytics can help libraries allocate resources more efficiently by providing information for decision-making processes (Ren et al., 2019).

The incorporation of AI technologies greatly improves LIS user engagement. Chatbots improve information access and build a sense of connection between users and library services by responding to user enquiries instantly (Egara & Mosimege, 2024). In a time when consumers demand prompt and effective service, this instantaneity is essential. Additionally, libraries can customise user experiences thanks to AI-driven data analytics. Libraries can develop focused outreach initiatives, provide resource recommendations, and even alter user interfaces to accommodate personal preferences by analysing user behaviour. Increased patron happiness

and loyalty may result from this degree of personalisation, which would eventually improve libraries' overall service delivery (Yang et al., 2022).

Augmented reality (AR) and virtual reality (VR)

Innovative learning opportunities in LIS education are provided by cutting-edge technology like virtual reality (VR) and augmented reality (AR). Users can browse digital collections in replicated spaces thanks to virtual reality's immersive surroundings. Virtual reality (VR) can be used by libraries to create virtual tours that let patrons explore collections, engage with exhibits, and even attend events from the comfort of their homes (Chang et al., 2022). For example, the New York Public Library has created a virtual reality experience that enables visitors to engage with historical collections (Kot & Jones, 2015). Conversely, augmented reality (AR) improves the in-person library experience by superimposing digital data on the physical world. AR apps, for instance, can direct people to particular books on shelves or give them more details about exhibits via their cellphones. This interactive layer enhances the learning process and encourages participation. VR and AR technology have been successfully incorporated into training programs by a number of organisations. For its employees, the University of Illinois Library created a virtual reality training program that lets them practise customer service scenarios in a risk-free setting. This strategy improves customer relations in addition to staff competencies (Connell et al., 2021).

Cloud Computing

Because cloud computing offers scalable options for data storage and accessibility, it has revolutionised resource management in LIS. Without requiring substantial physical infrastructure, libraries can store enormous volumes of digital resources by using cloud services (Kunal et al., 2019a). This move to cloud-based solutions improves user accessibility while lowering operating expenses. For example, many libraries now use cloud-based platforms to hold their digital collections, allowing users to access resources from any device with internet connectivity. In today's mobile-driven environment, where people expect to access information at any time and from any location, this flexibility is crucial.

Tools for Collaboration

Additionally, cloud computing makes it easier for library employees and users to work together. Librarians can collaborate on projects, share documents, and communicate easily thanks to programs like Google Drive and Microsoft Teams (Kunal et al., 2019b). In library environments, this cooperative atmosphere fosters creativity and increases productivity. Additionally, cloud-based services can facilitate user collaboration in learning. Libraries can establish common areas where users can collaborate on group projects, exchange materials, and have conversations (Ezeanya et al., 2024). Libraries are vital centers of cooperation because they promote a feeling of community and improve the educational process.

Analytics and Big Data

Libraries can examine enormous volumes of data regarding user behaviour and preferences thanks to big data analytics. Librarians may learn a lot about the most popular resources, how patrons use the library, and which services are most frequently used by utilising data from databases, catalogues, and user interactions (Singh & El-Kassar, 2019). Libraries are able to make well-informed decisions about service development and resource allocation thanks to this data-driven strategy. To raise awareness and utilisation, libraries can, for example, identify underutilised resources and create focused marketing efforts. Furthermore, by examining user behaviour, new services that are in line with customer interests can be developed (Anshari et al., 2022). Decision-making procedures are improved when big data analytics are incorporated

into library administration. Data can be used by librarians to predict future requirements, spot trends, and evaluate the success of projects. For instance, libraries can identify popular genres or subjects and modify their collections by examining circulation data. Additionally, data analytics can help with strategic planning projects. Libraries can set objectives, track results, and assess the effectiveness of their services using insights gleaned from user data. Librarians may lobby for resources and support inside their institutions thanks to this evidence-based strategy (Singh & El-Kassar, 2019).

Tools for Digital Curation

In libraries, digital curation technologies are essential for maintaining and organising digital resources. With the use of these tools, librarians may preserve digital archives, handle metadata, and make sure that collections are always available (Bester et al., 2021). Maintaining the integrity and usability of digital materials requires effective digital curation. To build and maintain digital collections, libraries are increasingly using programs like CONTENTdm and Omeka. By cataloguing, displaying, and sharing digital resources, these platforms enable librarians to facilitate users' discovery and access to important information. Libraries can increase the impact and exposure of their holdings by implementing strong digital curation methods (Ojo et al., 2024).

Integration of Social Media

Libraries now rely heavily on social media to interact with patrons and advertise their offerings. Libraries can highlight new resources, provide information, and promote community involvement on social media sites like Facebook, Twitter, and Instagram (Opele et al., 2024). In the end, this integration increases user engagement by strengthening the bond between libraries and their clients. For instance, a lot of libraries use social media platforms to conduct online events like seminars or author presentations (Adebanjo et al., 2024). This broadens the library's audience and improves accessibility for patrons. Additionally, libraries can improve their outreach initiatives by using social media analytics to learn more about user interactions (Adams et al., 2020).

Resources for Open Education (OER)

The way educational materials are accessible and used in LIS education has significantly changed as a result of Open Educational Resources (OER). Open Educational Resources (OER) are publicly available, openly licensed resources that promote sharing and reuse in research, teaching, and learning (Mićunović et al., 2023). Libraries are essential to the promotion of Open Educational Resources (OER) because they make high-quality educational materials accessible without regard to cost. Libraries can meet a variety of learning requirements and improve access to knowledge by integrating OER into their services. In order to allow instructors and students to use these resources in their classes, university libraries are, for example, progressively developing OER collections that correspond with curricular requirements (Odigwe & Owan, 2020).

Cooperation in Education

OER adoption creates cooperative learning settings that are advantageous to educational institutions and libraries alike. By collaborating with academics to create and carry out OER projects, libraries can foster a collaborative culture within the academic community. Innovative teaching strategies and better learning results may result from this partnership (Opeke & Opele, 2014). Moreover, libraries can conduct workshops and training sessions for professors on how to properly integrate OER into their courses. Libraries can enable instructors to adopt OER by

offering resources and support, which will ultimately improve students' educational experiences (Opele, 2022).

Mobile Technology

Users' access to library materials and services has been revolutionised by mobile technologies. Mobile applications that improve user access to library resources have been developed as a result of the widespread use of smartphones and tablets (Adebanjo et al., 2024). Mobile apps that offer functions like account administration, catalogue searches, and access to digital collections are being developed by libraries more frequently. For library websites to be mobile-friendly, responsive web design is also essential. Libraries may increase user engagement and satisfy the demands of a mobile-savvy audience by making their online platforms mobile-friendly. Studies show that mobile-friendly websites boost customer satisfaction and usage.

Experience of the User

The whole user experience is improved when mobile technologies are incorporated into LIS instruction. To produce user-friendly and captivating mobile experiences, libraries must give priority to user-centred design (Togia et al., 2012). This entails taking into account elements like accessibility features, information presentation, and navigation. Libraries can better serve their patrons' needs by utilising mobile technologies to give them easy access to resources and services. According to Vassilakaki and Garoufallou (2013), mobile technology can also help libraries and their patrons communicate by providing timely information and alerts about events, new acquisitions, and service modifications.

Blockchain Technology

Libraries now have a safe way to handle digital rights and transactions thanks to blockchain technology. Libraries may protect intellectual property and enable safe transactions by using blockchain to guarantee the validity and integrity of digital assets. This is especially crucial in a time when content providers face serious obstacles from copyright violations and digital piracy (Onayinka et al., 2024). Blockchain, for instance, can be used by libraries to monitor the ownership and licensing of digital resources, guaranteeing that authors receive fair compensation for their labour. This degree of security promotes the usage of library resources and increases confidence in digital collections. Another important advantage for libraries is the transparency that blockchain technology offers. Libraries can produce verifiable records of transactions and interactions with digital resources by keeping a decentralised ledger. This openness encourages responsibility and can improve the legitimacy of library services. Additionally, blockchain can facilitate the preservation of digital archives by providing a secure and immutable record of historical documents and valuables. This guarantees that priceless resources will be available and safeguarded for upcoming generations (Mohamed et al., 2023).

Gamification

Gamification is a cutting-edge strategy that adds gaming aspects to learning environments to increase student motivation and engagement. Gamification can be utilised to create interactive learning experiences in LIS education that promote skill development and active involvement (Aini, 2020). Libraries can use gamification techniques in a number of ways, including interactive learning modules, quizzes, and scavenger hunts. These exercises encourage cooperation and teamwork among students in addition to making learning enjoyable and interesting. In LIS education, gamification can also aid in skill development (Zahedi et al., 2021). Libraries can assist students in developing critical thinking, problem-solving, and information literacy skills by integrating gaming components into training programs. Libraries can, for instance, provide simulation-based learning activities in which students must traverse

real-world situations to locate information or fix problems. By fostering a greater grasp of library resources and services, this active learning strategy equips students for future employment difficulties. Gamification is a useful tactic in LIS education since research shows that can result in better learning outcomes and higher retention rates (Armstrong & Landers, 2018).

Platforms for Collaborative Learning

In LIS education, collaborative learning platforms have become popular since they encourage students and professors to share knowledge and learn from one another. By enabling users to participate in conversations, exchange resources, and collaborate on projects, these platforms promote communication and teamwork (Aviamu et al., 2024). For instance, a lot of libraries have used tools like Microsoft Teams and Slack to establish online workspaces. By allowing students to interact with one another, ask for assistance, and exchange ideas, these resources promote a feeling of support and community inside the library setting (Bradley, 2020). A move toward a more inclusive and interactive approach to learning is reflected in the emphasis on collaborative learning in LIS education. Libraries can encourage users to share their knowledge by holding workshops, webinars, and discussion forums. In addition to improving the educational process, this gives students the confidence to take charge of their education. Libraries may develop a culture of ongoing learning and creativity by encouraging collaborative settings. This strategy improves the general efficacy of library services in addition to helping students.

Challenges in incorporating new technology into library and information science education

It is important to note that developing technologies have had a considerable impact on library and information science education. Nevertheless, there are several obstacles to overcome when integrating these technologies into LIS education. The digital divide, which exacerbates disparities in access to resources and information, is one significant issue. It is challenging to deploy cutting-edge technologies equitably since many libraries serve groups with differing degrees of digital literacy and access to technology. According to recent research, libraries run the danger of alienating some user segments if they don't address these differences (Khoeni et al., 2025).

Apart from the digital divide, library employees and patrons urgently require proper training. It's possible that many professionals lack the abilities needed to use and use these technologies successfully. Research demonstrates that continual professional development is crucial in helping librarians adapt to emerging tools, although many institutions fail to provide sufficient training programs (Moin Ud Din et al., 2022). This skills gap may restrict the potential benefits of new technologies by impeding their successful integration. Furthermore, ethical issues and worries about data protection pose serious obstacles. Libraries must carefully negotiate challenges pertaining to user data protection and intellectual property rights when they use AI and analytics capabilities. The adoption of new technologies may be hampered by user mistrust caused by unclear governance frameworks for data usage (Michael et al., 2014).

Lastly, a cultural change within library organisations is frequently necessary for the adoption of new technology. To effectively benefit from technology improvements, libraries must reorganise their services and modify their operations. As it entails involving multiple stakeholders and coordinating organisational objectives with technology capabilities, this can be a challenging process (Islam et al., 2024). As we maximise the potential of emerging technologies in LIS education, carefully addressing these issues will be crucial.

Conclusion

Emerging technology integration in Library and Information Science (LIS) education is a fundamental change that redefines the function of libraries and librarians in the digital age, rather than just improving current practices. Artificial Intelligence (AI), Virtual Reality (VR), Cloud Computing, and Big Data are examples of technologies that are revolutionising the delivery, management, and accessibility of information. These developments are fostering collaborative settings in libraries, improving user engagement, and enabling personalised learning experiences. The study emphasises how important it is to use these tools in order to prepare aspiring librarians for the opportunities and challenges they would encounter in the workplace. LIS programs may develop a generation of information workers with the knowledge and abilities needed to prosper in a quickly changing information environment by embracing innovations.

Recommendations

The following suggestions are made:

- First. Curriculum development needs to be given top priority in order to successfully incorporate developing technologies into LIS education. Courses on cutting-edge technologies like AI, VR, and data analytics should be part of LIS schools' forward-thinking curricula.
- Two. To enable students to interact with new technologies in meaningful ways, LIS curricula should prioritise real-world applications and practical experiences.
- Third. Students should be given the chance to collaborate with technology specialists and engage in project-based learning.
- Four. To guarantee that LIS professors and departments are prepared to teach cutting-edge techniques and technology, educators must engage in ongoing professional development.
- Fifth. Training programs that give teachers the information and abilities they need to successfully incorporate technology into their lesson plans should be funded by educational institutions. This process can be facilitated via workshops, webinars, and collaborative learning opportunities, which allow instructors to stay up to date on the most recent developments in technology and pedagogy.
- Sixth. To increase the resources and knowledge available to LIS programs, collaborations between tech firms and academic institutions must be fostered.
- Seven. Innovative instructional resources, cooperative research projects, and shared training opportunities can result from such partnerships.

Future implication

The role of librarians will change dramatically as technology develops. In order to improve service delivery, future librarians will need to be skilled in both managing traditional library resources and utilising innovative technologies. They will play a crucial role in promoting equitable access to information while assisting users in navigating the complexity of digital resources. Furthermore, the capacity to use technology and analyse data will establish librarians as strategic leaders in their companies. In the end, they will contribute to the mission of advancing knowledge and learning in their communities by helping to shape library services that are in line with user demands and institutional objectives.

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INNOVATIVE TECHNOLOGIES IN PHYSICS EDUCATION: A CONCEPTUAL FRAMEWORK FOR TRANSFORMATION AND SUSTAINABLE DEVELOPMENT

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Abstract

The integration of innovative technologies in Physics education has emerged as a critical factor in transforming traditional pedagogical approaches and promoting sustainable educational development. This paper presents a comprehensive conceptual framework that examines how emerging technologies such as virtual reality (VR), augmented reality (AR), artificial intelligence (AI), simulation software, and mobile learning platforms are reshaping Physics instruction. Through systematic analysis of current literature, this study identifies key technological innovations, their pedagogical implications, and their potential for creating sustainable learning environments. The proposed framework addresses the challenges of traditional Physics education, including abstract concept visualization, student engagement, and accessibility barriers. The evidence demonstrates that technology-enhanced Physics education improves student comprehension and retention while contributing to sustainable development goals through inclusive, equitable, and quality education. Successful implementation requires strategic planning, teacher training, infrastructure development, and continuous assessment. Unlike prior studies that treat technology adoption and sustainability as separate concerns, this paper advances an integrative model that simultaneously addresses pedagogy, sustainability, and long-term implementation in Physics education.

Keywords: *Physics education, educational technology, virtual and augmented reality, artificial intelligence, sustainable development*

Introduction

Physics education has long been challenged by the abstract nature of its concepts, mathematical complexity, and the difficulty students face in connecting theoretical principles to real-world applications (Redish, 2003). Traditional lecture-based approaches often fail to engage students effectively, leading to decreased enrolment in Physics courses and limited understanding of fundamental concepts (Mazur, 1997). The emergence of innovative technologies presents unprecedented opportunities to address these challenges and transform Physics education into a more engaging, accessible, and effective learning experience. The integration of technology in education has evolved from simple computer-assisted instruction to sophisticated immersive learning environments that simulate complex physical phenomena (Clark & Mayer, 2016). In Physics education specifically, VR, AR, AI, and advanced simulation software are creating new possibilities for visualizing abstract concepts, conducting virtual experiments, and delivering personalized learning experiences (Merchant et al., 2014). Alongside this technological evolution, the principle of sustainable development in education emphasizes the need for practices that are environmentally responsible, economically viable, and socially equitable (UNESCO, 2017).

Despite this growing body of work, a critical gap persists. Existing studies largely investigate individual technologies, VR, AI, or simulation software in isolation, without examining how these tools interact within a broader pedagogical and sustainability framework. What existing literature fails to integrate is a unified model that simultaneously accounts for

pedagogical effectiveness, long-term institutional viability, and equitable access. This manuscript uniquely contributes to the field by proposing an integrative conceptual framework that bridges technology adoption, constructivist pedagogy, and sustainable development in the specific context of Physics education. This paper thus aims to develop a comprehensive conceptual framework examining how innovative technologies can transform Physics education while promoting sustainable development — addressing technological tools, pedagogical applications, implementation strategies, and their contribution to creating sustainable educational ecosystems.

Literature Review

Traditional Challenges in Physics Education

Physics education has historically faced persistent challenges that hinder effective learning outcomes. Halloun and Hestenes (1985) identified that students commonly hold preconceived misconceptions about physical phenomena that resist change through conventional instruction. Building on this, Wieman (2007) argued that even capable students fail to develop coherent conceptual understanding when instruction relies primarily on abstract formalism, suggesting that the problem is not merely cognitive but fundamentally pedagogical. Where Halloun and Hestenes focused on identifying these misconceptions, Wieman went further to advocate for evidence-based instructional reforms, a tension that frames the debate about what technology must accomplish in Physics classrooms. Mathematical complexity further compounds these challenges. Redish and Kuo (2015) demonstrated that the disconnect between mathematical representations and physical intuition leads students toward procedural problem-solving that lacks conceptual grounding. This finding is significant because it implies that technology integration must address not only visualization but also the language-mathematics interface in Physics learning.

Technological Innovations in Education

Virtual reality technology enables immersive learning environments where students can explore three-dimensional representations of physical phenomena (Jensen & Konradsen, 2018). Studies show VR improves spatial understanding and knowledge retention. By contrast, augmented reality (AR) takes a different approach: rather than replacing the environment, it overlays digital information onto the real world, allowing students to visualize invisible phenomena such as magnetic fields or electric currents in their actual surroundings (Akçayır & Akçayır, 2017). While Jensen and Konradsen emphasize VR's power for immersion, Akçayır and Akçayır highlight AR's advantage in grounding abstract phenomena in tangible, real-world contexts — a distinction with direct implications for curriculum design.

AI and machine learning technologies create adaptive learning systems personalized to individual student needs (Zawacki-Richter et al., 2019). Importantly, Luckin et al. (2016) caution that AI effectiveness depends heavily on the quality of instructional design rather than the sophistication of the technology itself a nuance that many technology-optimistic studies overlook. Interactive simulations, such as those from PhET Interactive Simulations, allow students to manipulate variables and observe real-time effects on physical systems (Wieman et al., 2008), and have been shown to improve conceptual understanding and problem-solving skills, particularly when embedded within guided inquiry frameworks.

Sustainability in Educational Technology

The concept of sustainable development in education encompasses environmental, economic, and social dimensions. Potkonjak et al. (2016) demonstrated that virtual laboratories reduce the need for physical equipment, thus decreasing environmental impact and expanding access for resource-constrained institutions. Bates (2015) extended this argument to economics, noting

that while digital platforms require upfront investment, their scalability substantially reduces per-student costs over time. However, Rose and Meyer (2002) introduced a critical counter-perspective: economic and environmental sustainability gains are undermined if the resulting platforms exclude learners with disabilities or from underserved communities. These three perspectives environmental, economic, and social, form the sustainability backbone of the framework proposed in this paper. Crucially, no existing study has integrated all three sustainability dimensions into a single Physics-specific technology framework. The present paper addresses this gap directly.

Theoretical Framework

The proposed framework draws on four complementary theoretical traditions, each linked to a specific component of the integrated model.

Constructivist Learning Theory

Piaget's (1977) constructivism, which holds that learners build understanding through direct interaction with their environment, underpins the Learner Engagement and Pedagogical Integration components of the framework. Innovative technologies align with constructivist principles by providing interactive environments where students explore phenomena, test hypotheses, and manipulate variables (Jonassen, 1999). VR and AR, in particular, enable experiences previously impossible in traditional settings.

Social Constructivism

Vygotsky's (1978) social constructivist theory emphasizes the zone of proximal development and the importance of social interaction in learning. This theory informs the Learner Engagement component, particularly regarding collaborative virtual environments that allow students to co-investigate physics problems and construct shared understanding across geographical boundaries (Dillenbourg, 1999).

Cognitive Load Theory

Sweller's (1988) Cognitive Load Theory informs the Assessment and Feedback and Technological Infrastructure components. Well-designed educational technologies reduce extraneous cognitive load by presenting information clearly while increasing germane cognitive load through meaningful inquiry activities (Mayer, 2014). For example, interactive simulations reduce the cognitive burden of complex calculations, directing student attention toward conceptual relationships rather than procedural demands.

Technology Acceptance Model

Davis's (1989) Technology Acceptance Model (TAM), particularly its elaboration by Venkatesh and Davis (2000), informs the Sustainability Mechanisms and Pedagogical Integration components. TAM identifies perceived usefulness and ease of use as the key factors governing technology adoption. For physics education, this means that even technically superior tools will fail to deliver sustainable impact if educators and students do not find them pedagogically meaningful and operationally accessible.

The Conceptual Framework: Components and Integration

Despite numerous studies on educational technology, there is limited integrative conceptual modeling that simultaneously addresses pedagogy, sustainability, and long-term implementation in Physics education. The proposed framework responds to this gap through five interconnected components, Technological Infrastructure, Pedagogical Integration, Learner Engagement, Assessment and Feedback, and Sustainability Mechanisms, each

grounded in an established theoretical tradition and mapped to one or more dimensions of sustainability. Figure 1 below provides a visual schematic of the framework, illustrating how the five components orbit and reinforce a central goal of Technology-Enhanced Physics Education, with bidirectional arrows denoting their interdependence.

Figure 1: Conceptual Framework for Innovative Technologies in Physics Education

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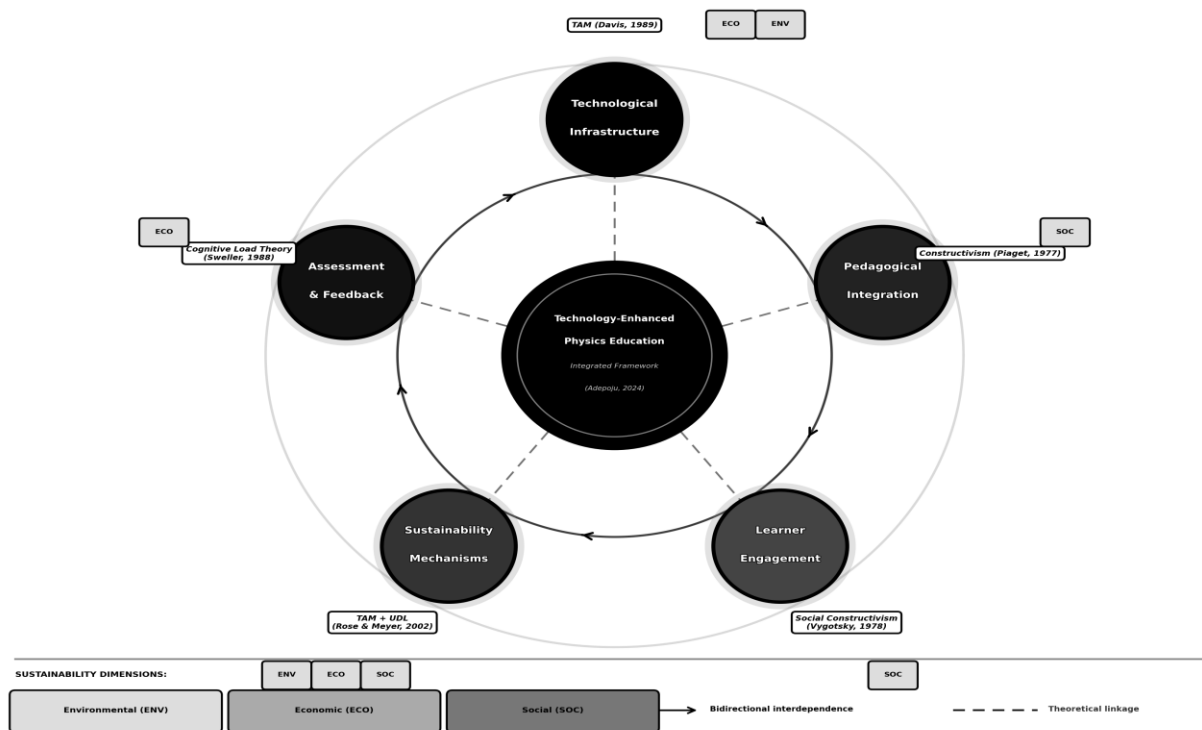


Figure 1: Conceptual Framework for Innovative Technologies in Physics Education (Adepoju, 2024)

Note: Coloured badges denote sustainability dimensions — ENV = Environmental, ECO = Economic, SOC = Social.

Reading the Framework Diagram

Figure 1 presents the framework as a hub-and-spoke model in which the five components are arranged equidistantly around a central hub labelled "Technology-Enhanced Physics Education." This spatial arrangement is intentional: it communicates that no single component operates in isolation, and that each feeds into and draws from the others through continuous bidirectional relationships (represented by the directional arcs). The dashed spokes connecting each node to the hub represent the theoretical linkages, specifically, the pathway by which each theoretical foundation (shown in italicised labels outside each node) informs both the individual component and the overarching educational goal at the centre. The outer coloured badges (ENV, ECO, SOC) map each component to its corresponding sustainability dimension(s): green for Environmental, orange for Economic, and purple for Social sustainability. The Sustainability Mechanisms component uniquely carries all three badges, reflecting its role as the integrative anchor of the model's long-term viability.

The framework is designed to be read both vertically, from Technological Infrastructure (the prerequisite layer) upward through Pedagogical Integration and Learner Engagement to Assessment and Feedback, and cyclically, recognising that assessment data feeds back into

infrastructure investment and pedagogical refinement. Sustainability Mechanisms, positioned at the lower-left, function not as an afterthought but as a foundational constraint: every decision in the other four components must be filtered through the question of long-term environmental, economic, and social viability.

Technological Infrastructure

This component encompasses the hardware, software, and network resources required for technology-enhanced learning, including VR/AR devices, high-speed internet, learning management systems, and technical support services. Grounded in TAM, the infrastructure must be reliable, scalable, and accessible to ensure both adoption and long-term sustainability.

Pedagogical Integration

Pedagogical Integration refers to the purposeful incorporation of technology into curriculum design and instructional practice, aligned with the TPACK (Technological Pedagogical Content Knowledge) framework of Mishra and Koehler (2006). Unlike infrastructure, which enables access, this component determines whether technology transforms or merely supplements learning. Its theoretical grounding in constructivism ensures that technology serves inquiry-based, student-centered pedagogy rather than replicating passive instruction in digital form.

Learner Engagement

This component addresses how technology increases student motivation, active participation, and investment in Physics learning. Interactive simulations, gamification, and immersive VR/AR experiences operationalize both Piagetian and Vygotskian principles by creating environments for individual exploration and collaborative inquiry. Learner engagement connects directly to sustainability: disengaged students increase institutional costs through remediation and attrition.

Assessment and Feedback

Formative assessment tools, AI-powered adaptive testing, and learning analytics constitute this component. Consistent with Cognitive Load Theory, effective assessment design reduces cognitive demands during evaluation while generating actionable data for instructional adjustment. This component also enables the evidence base needed to justify continued investment, addressing the return-on-investment challenge identified in the literature.

Sustainability Mechanisms

The final component addresses the long-term viability of technology integration across environmental (virtual labs reducing material waste), economic (open-source and scalable platforms), and social (universal design, digital equity) dimensions. The integration of all three sustainability perspectives, drawing from Potkonjak et al. (2016), Bates (2015), and Rose and Meyer (2002) respectively, is a defining feature of this framework and its primary contribution over prior models.

Application of the Framework: Case Evidence

Three empirical cases are examined here not as independent literature, but as illustrative evidence for specific framework components.

VR in Quantum Mechanics (Stanford University)

Müller and Ferreira's (2018) VR implementation for quantum mechanics undergraduate instruction operationalizes the Learner Engagement and Technological Infrastructure

components. Students used VR headsets to explore three-dimensional wave functions, manipulating potential energy barriers in real-time. Pre- and post-assessments showed significant conceptual gains, particularly for students who struggled with traditional mathematical representations. Critically, the software could be updated remotely and reused across cohorts, demonstrating the Sustainability Mechanisms component, eliminating the need for expensive physical equipment while expanding access.

AR for Electromagnetic Field Visualization (UC Berkeley)

Santos et al. (2019) implemented an AR mobile app enabling students to visualize electromagnetic fields overlaid on physical objects. This case exemplifies the Pedagogical Integration component: the technology was deliberately aligned with curriculum goals around field theory, not deployed for novelty. The use of students' own smartphones eliminated specialized hardware costs, a direct Economic Sustainability strategy consistent with Bates (2015). Students demonstrated improved spatial reasoning and field concept understanding, confirming the framework's premise that purposeful pedagogical integration drives outcomes.

AI-Powered Adaptive Tutoring in Mechanics (Georgia Tech)

Rau et al.'s (2020) adaptive tutoring system for classical mechanics illustrates the Assessment and Feedback component at scale. Machine learning algorithms identified common misconceptions and personalized instructional sequences accordingly, resulting in improved problem-solving performance and reduced time-to-mastery. The system continuously improved through ongoing data, embodying Sustainability Mechanisms through scalability: one system could deliver individualized feedback to thousands of students simultaneously, a capability that directly addresses the economic sustainability argument advanced by Bates (2015).

Discussion

How the Framework Advances Existing Knowledge

The framework presented in this paper makes three substantive contributions to the educational technology literature. First, it resolves the fragmentation evident in prior work: where Akçayır and Akçayır (2017) addressed AR advantages in isolation, and Zawacki-Richter et al. (2019) focused narrowly on AI personalization, this framework maps these technologies onto an integrated model in which each component reinforces the others. Second, by systematically linking theoretical foundations, constructivism, social constructivism, Cognitive Load Theory, and TAM, to specific framework components, the paper provides educators and researchers with theoretically grounded design principles rather than generic prescriptions. Third, the simultaneous treatment of environmental, economic, and social sustainability in a single Physics-specific model is, to the author's knowledge, without direct precedent in the field.

Implications for Practice

For educators, the framework implies a shift from technology-driven to pedagogy-driven integration: the question is not "which technology is available?" but "which framework component does this technology address?" Teachers equipped with TPACK and trained in constructivist design are better positioned to leverage VR, AR, and AI as complementary tools within a coherent instructional sequence rather than isolated novelties. The framework also legitimizes investment in professional development as a sustainability strategy, not merely a capacity-building exercise.

For institutions, the framework's Sustainability Mechanisms component suggests that short-term infrastructure investments in virtual laboratories, open-source platforms, and accessible device programs can generate long-term reductions in per-student costs, laboratory

maintenance, and remediation expenditure. Institutions adopting the framework should establish baseline data across all five components before scaling, enabling evidence-based iteration.

Implications for Policy

Policymakers can use the framework as an evaluation rubric for technology integration proposals. A proposal that addresses only Technological Infrastructure without articulating Pedagogical Integration, Learner Engagement, Assessment, and Sustainability is likely to underperform. Equity considerations, particularly digital divide mitigation and universal design requirements should be mandated as baseline conditions rather than optional enhancements. The framework further suggests that funding mechanisms should support cross-institutional resource sharing, an approach aligned with the economic sustainability component.

Suggestions

For Educational Institutions

Strategic Planning: Institutions should develop comprehensive technology integration plans that align with their mission, student needs, and resource constraints. These plans should include clear goals, timelines, and success metrics.

Professional Development Investment: Institutions must prioritize ongoing professional development for educators, focusing on both technical skills and pedagogical knowledge. This investment is crucial for successful technology implementation.

Infrastructure Development: Reliable technical infrastructure is essential for effective technology integration. Institutions should invest in robust networking, computing resources, and technical support services.

Partnerships and Collaboration: Institutions should seek partnerships with technology companies, other educational organizations, and research institutions to share resources and expertise.

For Educators

Continuous Learning: Educators should embrace lifelong learning and actively seek opportunities to develop technology integration skills. This includes formal training programs, professional learning communities, and self-directed exploration.

Student-Centered Approach: Technology integration should focus on student learning outcomes rather than the technology itself. Educators should select and implement technologies that address specific learning challenges and goals.

Evidence-Based Practice: Educators should base technology integration decisions on research evidence and continuously evaluate the effectiveness of their approaches through student feedback and learning assessment.

Collaboration and Sharing: Educators should collaborate with colleagues to share experiences, resources, and best practices in technology integration.

For Policymakers

Funding Support: Policymakers should provide adequate funding for technology integration initiatives, including infrastructure development, device procurement, and professional development programs.

Equity Considerations: Policies should address digital divide issues and ensure equitable access to technology-enhanced education opportunities for all students.

Standards and Guidelines: Clear standards and guidelines for educational technology integration can help ensure quality and consistency across institutions.

Research Support: Policymakers should support research on educational technology effectiveness and best practices to inform evidence-based policy decisions.

For Technology Developers

User-Centered Design: Educational technology developers should prioritize user experience and pedagogical effectiveness over technical sophistication. Close collaboration with educators and students is essential during the design process.

Accessibility and Inclusion: Technologies should be designed to accommodate diverse learners, including those with disabilities and from different cultural backgrounds.

Sustainability Considerations: Developers should consider the environmental, economic, and social sustainability implications of their technologies throughout the design and development process.

Open Standards: Support for open standards and interoperability will facilitate integration with existing educational systems and reduce vendor lock-in concerns.

Limitations and Future Directions

This paper is conceptual in nature; empirical validation of the integrated framework across diverse institutional contexts remains a priority for future research. The framework was developed primarily from studies conducted in high-income contexts, and its applicability to low-resource settings, while theoretically supported through the Social Sustainability component, requires empirical examination. Emerging technologies, including extended reality (XR) platforms, quantum computing education tools, and brain-computer interface applications, will require iterative framework updates as evidence accumulates.

Conclusion

The integration of innovative technologies in Physics education represents a transformative opportunity to address longstanding challenges in science learning while advancing sustainable development goals. This paper has presented a conceptual framework comprising five interconnected components — Technological Infrastructure, Pedagogical Integration, Learner Engagement, Assessment and Feedback, and Sustainability Mechanisms — each grounded in established theoretical traditions and illustrated through empirical case evidence.

The central argument is that technologies such as VR, AR, AI, and simulation software cannot independently improve Physics education; their impact depends on purposeful pedagogical integration, equitable access, and long-term institutional sustainability. By providing educators, policymakers, and researchers with a structured, theoretically grounded approach, this framework advances the field beyond individual technology evaluations toward an integrative model capable of guiding sustainable transformation in Physics education globally.

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PROFESSIONAL DEVELOPMENT AS A CATALYST FOR TRANSFORMATIVE PEDAGOGY AND SUSTAINABLE EDUCATION IN SENIOR SECONDARY SCHOOLS IN GARKI, FCT, ABUJA, NIGERIA

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Abstract

Education for Sustainable Development (ESD) requires transformative pedagogical approaches that move beyond traditional teacher-centred instruction. However, public secondary schools in Nigeria's Federal Capital Territory (FCT) continue to rely heavily on conventional teaching methods that inadequately prepare students for sustainability challenges. This study investigates how professional development programmes can facilitate the adoption of transformative pedagogy and sustainable educational practices. A descriptive study was conducted with 200 teachers from public secondary schools in Garki, FCT, Abuja. Data were collected through a structured questionnaire and analysed using descriptive and inferential statistics. Findings revealed that 78% of teachers had limited access to comprehensive professional development programmes focused on transformative pedagogy. Teachers who participated in structured professional development programmes showed significantly higher adoption rates of student-centred teaching methods ($p < 0.05$) and were 2.3 times more likely to integrate sustainability themes into their curriculum. Professional development emerged as the strongest predictor of transformative teaching practices ($\beta = 0.67$, $p < 0.001$). These findings are significant as they demonstrate that context-responsive, continuous professional development programmes substantially enhance teachers' capacity to adopt learner-centred approaches aligned with ESD principles. The implications for educational practice are far-reaching, pointing to the urgent need for systematic, policy-driven investment in teacher professional growth as a foundational strategy for advancing sustainable education in Nigeria.

Keywords: Professional development, transformative pedagogy, sustainable education, teacher training, Nigeria.

Introduction

Education, broadly defined as the systematic process of facilitating the acquisition of knowledge, skills, values, and attitudes, serves as a cornerstone for individual empowerment and societal progress (Attahakul, 2025). In the 21st century, the purpose of education has evolved beyond the mere transmission of facts to encompass the development of learners who can think critically, collaborate effectively, and address complex global challenges. Central to achieving this vision are pedagogical approaches that actively engage students and prepare them for real-world problem-solving; approaches increasingly recognised as essential in contexts shaped by rapid socio-economic change, environmental pressures, and growing inequality.

Two interconnected concepts are particularly relevant to this evolving educational vision: transformative pedagogy and sustainable education. Transformative pedagogy refers to instructional approaches that deliberately shift the focus of learning from teacher-centred delivery to student-centred engagement, empowering learners to become active, reflective, and socially conscious participants in their own education (Dwikamayuda, Maye, Ekawati, Nitiasih, Riastini & Sudatha 2024). Sustainable education, on the other hand, is grounded in the principles of Education for Sustainable Development (ESD). A globally recognised framework that equips learners with the knowledge, values, and competencies needed to contribute to environmental integrity, economic viability, and social justice for present and future generations (Yadav, 2024). Together, these two frameworks represent a coherent vision for 21st-century schooling that is responsive to both local realities and global imperatives.

Transformative pedagogy has emerged as a key pathway toward this educational vision. Its core elements include student-centred instruction, which empowers learners to take ownership of their education; critical thinking facilitation, which encourages the analysis and evaluation of ideas; collaborative learning, which fosters teamwork and shared problem-solving; reflective practice, which enables both teachers and learners to examine and continuously refine their approaches; and inquiry-based learning, which promotes curiosity and systematic investigation (Yusuf, Adanle, Jolaoso, Abimbola, Aina, Abubakar & Ajibade 2024). Together, these practices cultivate the competencies needed for adaptive, engaged, and socially responsible citizenship. However, realising this vision in practice requires more than curricular reform. It demands a fundamental reorientation of teaching roles and classroom culture, a shift that is particularly challenging in contexts where socio-economic constraints limit access to resources, infrastructure, and professional support.

Central to enabling this shift is professional development for teachers. According to Khong and Nguyen (2022), professional development involves equipping teachers with the skills, knowledge, and mindsets required to transition from traditional, rote-based methods to learner-centred, sustainability-oriented instruction. In contexts marked by socio-economic challenges, such as underfunded schools, overcrowded classrooms, and limited institutional support, targeted professional development becomes even more critical, as it provides teachers with the tools and confidence necessary to innovate within constrained environments. Yadav (2024) remarked that through structured training, expert facilitation, mentorship, and collaborative capacity-building, teachers can design learning experiences that meaningfully integrate the principles of transformative pedagogy with sustainability themes.

The Federal Capital Territory (FCT), Abuja, as Nigeria's administrative and political centre, represents a compelling case study for this kind of educational transformation. Public secondary schools in the FCT are expected to model innovative educational practices for the broader Nigerian system. Yet despite this expectation, the integration of transformative pedagogy and sustainability education in these schools remains inconsistent, largely due to professional development programmes that are inadequately targeted, episodic, and insufficiently aligned with ESD principles. This study addresses this gap by examining the role of professional development in fostering transformative pedagogy and integrating sustainability education in public secondary schools in the FCT, Abuja. By linking specific transformative pedagogy practices with defined sustainability themes, the research seeks to provide evidence-based strategies for strengthening teacher capacity and advancing Nigeria's progress toward its educational and sustainability goals.

This study is grounded in transformative learning theory, originally developed by Mezirow (1991), which posits that meaningful learning involves critical reflection on assumptions, beliefs, and practices, leading to fundamental changes in perspective and behaviour. This position has been reaffirmed by recent scholars such as Fleming (2022) and Sugito (2024), who emphasise that transformative learning entails a deep restructuring of

individuals' frames of reference through reflective processes. Within the context of teacher education, this theoretical framework provides a powerful lens for understanding how professional development can serve as a vehicle for pedagogical transformation. By creating structured opportunities for educators to examine their instructional assumptions, experiment with innovative approaches, and develop competencies aligned with the principles of sustainable education, professional development becomes not merely a training activity but a catalyst for big, lasting change in teaching practice. The following review traces this argument across four interconnected thematic areas: professional development, transformative pedagogy, sustainable education and ESD implementation, and professional development as a catalyst for change.

Professional Development

Professional development encompasses structured educational programmes and learning experiences designed to enhance teachers' pedagogical knowledge, content mastery, and classroom practices (Achieng, 2024). Effective professional development is characterised by several key features: continuity over time, collaborative engagement among educators, context-specificity to local needs and challenges, and alignment with both institutional goals and individual teacher development needs. Iqbal and Ali (2024) emphasise that professional development must extend beyond traditional workshop models to include sustained, practice-based learning experiences that enable teachers to experiment with new approaches in supportive environments. This perspective aligns with the contemporary understanding of teacher learning as a complex, socially mediated process requiring ongoing support and reflection.

Transformative Pedagogy

Transformative pedagogy represents a fundamental departure from traditional instructional approaches, emphasising student agency, critical inquiry, and social justice orientation (Dwikamayuda et al., 2024). Its core principles include dialogical teaching methods that position students as co-constructors of knowledge, critical examination of power relations and social structures, reflective practice that encourages continuous learning and adaptation, and authentic assessment that connects learning to real-world applications. Aliyeva (2024) argues that transformative pedagogy requires teachers to reconceptualise their roles from information deliverers to learning facilitators and critical thinking coaches, a shift that demands not only attitudinal change but also the acquisition of new instructional competencies. This reconceptualisation of teaching is directly relevant to the sustainability agenda, as it equips learners with the higher-order thinking and collaborative skills necessary to engage with complex, real-world challenges. However, while the theoretical case for transformative pedagogy is well established in the international literature, empirical studies documenting its actual implementation levels in Nigerian secondary schools remain scarce.

Sustainable Education and ESD Implementation

Sustainable education encompasses the knowledge, skills, values, and behaviours necessary to promote environmental integrity, economic viability, and social justice for current and future generations (Yadav, 2024). As a framework, ESD requires interdisciplinary approaches that connect local and global sustainability challenges while fostering systems thinking and collaborative problem-solving skills. Research consistently indicates that successful ESD implementation depends heavily on teacher preparedness and institutional support; educators must possess both substantive knowledge about sustainability issues and the pedagogical skills to facilitate meaningful student engagement with these complex topics (UNESCO, 2021). The link between transformative pedagogy and ESD is both logical and necessary: the student-

centred, inquiry-driven, and reflective practices that define transformative pedagogy are precisely the instructional strategies through which ESD competencies are most effectively developed. Yet despite this natural alignment, the integration of ESD principles into classroom practice in Nigerian secondary schools remains inconsistent and inadequately studied.

Professional Development as a Catalyst for Change

MacLatchy, Nguyen, Olulanke, Pownall, and Usman (2025) noted that strategically designed professional development programmes can effectively support teachers' adoption of transformative pedagogical approaches. Key design features that facilitate this transformation include targeted training aligned with specific instructional goals, equity-driven instructional strategies, collaborative learning communities, and ongoing mentorship and support structures. When these elements are present, professional development functions as a genuine catalyst, enabling teachers to translate new knowledge and skills into sustained changes in classroom practice.

Statement of the Problem

Despite growing international recognition of the importance of transformative pedagogy for sustainable education, significant gaps persist between policy aspirations and classroom realities. Teachers, often identified as key agents of educational change, frequently lack the pedagogical knowledge, resources, and institutional support needed to transition from traditional teaching methods to transformative, learner-centred approaches (Khong & Nguyen, 2022). Globally, studies have documented this disconnect: a UNESCO (2021) report found that fewer than 40% of teachers in low- and middle-income countries had received training aligned with ESD principles, while Olaifa, Ciroma, Olaifa, Onikoyi, and Shittu (2025) established that teacher professional development remains one of the most significant determinants of pedagogical innovation in school systems across sub-Saharan Africa. Professional development emerges as a potential catalyst for this transformation, yet empirical research examining the relationship between professional development, transformative pedagogy, and sustainable education remains limited, particularly in the Nigerian context. Nationally, studies such as Alhaji (2025) have highlighted that a significant proportion of Nigerian teachers continue to rely on didactic, teacher-centred instructional methods, with limited exposure to learner-centred alternatives. Similarly, Yusuf et al. (2024) observed that the majority of in-service teacher training programmes in Nigeria remain content-focused and examination-driven, with little attention given to the development of sustainability competencies or transformative instructional strategies. These gaps are particularly consequential given Nigeria's commitment to the Sustainable Development Goals (SDGs), particularly SDG 4, which calls for inclusive, equitable, and quality education that promotes lifelong learning opportunities for all.

In the FCT, Abuja, the situation reflects broader national trends. Observational evidence and preliminary assessments suggest that many public secondary schools in the territory continue to employ traditional, teacher-centred pedagogies that fall short of equipping students with the critical thinking, problem-solving, and participatory skills necessary to address contemporary sustainability challenges. Furthermore, despite a growing body of international literature on professional development and pedagogical transformation, little empirical research has specifically examined the precise mechanisms through which professional development influences teachers' capacity to implement and sustain transformative pedagogies in the context of public secondary schools in Abuja. This study, therefore, addresses this critical empirical gap by investigating the nature, accessibility, and impact of professional development programmes on transformative pedagogy adoption and

sustainability education integration among public secondary school teachers in FCT, Abuja, Nigeria.

Research Objectives

1. To identify the types of professional development programmes accessed by public secondary school teachers in Garki, FCT, Abuja, Nigeria.
2. To evaluate the implementation level of transformative pedagogical practices among teachers in public secondary schools in Garki, FCT, Abuja.

Research Questions

1. What types of professional development programmes do public secondary school teachers in Garki, FCT, Abuja, access?
2. What is the implementation level of transformative pedagogy among public secondary school teachers in Garki, FCT, Abuja?

Research Hypotheses

H₀₁: There is no significant relationship between the level of professional development participation and the adoption of transformative pedagogical practices among public secondary school teachers in Garki, FCT, Abuja.

Methodology

This study adopted the descriptive survey research design. The population comprised 720 teachers across public secondary schools in the Garki district, from which a sample of 200 teachers was selected from 10 schools. Schools were selected using a purposive sampling approach to ensure representation of both larger schools and smaller schools, after which simple random sampling was employed within each school to select individual participants proportional to school size. Data were collected using a structured questionnaire, the Professional Development and Transformative Pedagogy Questionnaire (PDTPQ), organised into three sections covering demographic information, types of professional development programmes accessed, and levels of transformative pedagogy implementation across five practice dimensions. All items were measured on a five-point Likert scale ranging from 1 (Very Low) to 5 (Very High). The validity of the instrument was established through a pilot test, with Cronbach's alpha coefficient of 0.78. Data were analysed using descriptive statistics and inferential statistics.

Results

Research Question One

What types of professional development programmes do public secondary school teachers in Garki, FCT, Abuja, access?

Table 1: Types of Professional Development Programmes Accessed by Public Secondary School Teachers in Garki, FCT, Abuja (N = 200; Multiple Responses Permitted)

PD Program Type	Frequency	Percentage (%)
Gov-sponsored workshop	32	16.0
NGO/International organisation program	18	9.0
University-based continuing education	12	6.0

School-based peer learning	28	14.0
Online professional courses	8	4.0
Subject-specific conference	15	7.5
No formal PD participation	156	78.0

Table 1 presents the types of professional development programmes accessed by public secondary school teachers in FCT, Abuja, addressing Research Question One. The most striking finding is that 78% of respondents ($n = 156$) reported no participation in any formal professional development programme, indicating that the overwhelming majority of teachers in the sample lack access to structured professional learning. Among those who did participate, government-sponsored workshops were the most commonly accessed programme type (16%, $n = 32$), followed by school-based peer learning (14%, $n = 28$), NGO and international organisation programmes (9%, $n = 18$), subject-specific conferences (7.5%, $n = 15$), university-based continuing education (6%, $n = 12$), and online professional courses (4%, $n = 8$). The low and fragmented participation rates across all programme types indicate that systematic, sustained professional development opportunities remain largely inaccessible to the majority of public secondary school teachers in the FCT, with significant implications for their capacity to adopt transformative pedagogical practices aligned with ESD principles. Note: Percentages do not sum to 100% as respondents were permitted to select more than one programme type.

The category "No formal PD participation" refers to teachers who indicated no engagement with any of the listed programme types.

Research Question Two

What is the implementation level of transformative pedagogy among public secondary school teachers in Garki, FCT Abuja, Nigeria?

Table 2: Transformative Pedagogy Practice Implementation Levels among Public Secondary School Teachers in Garki, FCT, Abuja (N = 200)

Practice Category	Mean Score	Standard Deviation	Implementation Level
Student-centered instruction	2.9	0.8	Moderate
Critical thinking facilitation	2.7	0.9	Moderate
Collaborative learning	3.2	0.7	Moderate
Reflective practice	2.5	0.8	Moderate
Inquiry-based learning	2.6	0.9	Moderate

Table 2 presents the implementation levels of five transformative pedagogy practice dimensions among public secondary school teachers in Garki, FCT, Abuja. Implementation levels were classified based on a predetermined decision rule whereby mean scores of 1.00–2.49 indicate Low implementation, 2.50–3.49 indicate Moderate implementation, and 3.50–5.00 indicate High implementation. Applying this benchmark, the overall pattern of findings indicates that transformative pedagogical practices are implemented at moderate to low levels across the sample. Collaborative learning recorded the highest mean score ($M = 3.2$, $SD = 0.7$),

reflecting a moderate level of implementation and relatively consistent practice across respondents, suggesting it is the most accessible dimension of transformative pedagogy for teachers in this context. Student-centred instruction similarly showed a moderate implementation level ($M = 2.9$, $SD = 0.8$). In contrast, critical thinking facilitation ($M = 2.7$, $SD = 0.9$), inquiry-based learning ($M = 2.6$, $SD = 0.9$), and reflective practice ($M = 2.5$, $SD = 0.8$) all recorded low implementation levels, indicating that these more cognitively demanding dimensions of transformative pedagogy are less consistently integrated into everyday classroom teaching. These findings collectively point to a significant gap between the ideals of transformative pedagogy and its actual realisation in FCT public secondary school classrooms, underscoring the need for targeted professional development interventions.

Research Hypothesis: H_{01} : There is no significant relationship between the level of professional development participation and the adoption of transformative pedagogical practices among public secondary school teachers in Garki, FCT, Abuja.

Table 3: One-Way ANOVA and Descriptive Statistics for Transformative Pedagogy Implementation by Professional Development Exposure Level (N=200)

Source	N	Mean TP Score	SD	95% CI	df	F	P	η^2
High PD Exposure	22	72.4	11.2	(67.3, 77.5)				
Moderate PD Exposure	22	64.8	12.6	(59.2, 70.4)				
Low PD Exposure	156	55.9	13.8	(53.7, 58.1)				
Between Group					2	18.42	<.001	.16
Within Group					197			
Total					199			

Table 3 presents the descriptive statistics and ANOVA results for transformative pedagogy implementation across the three professional development exposure levels. A clear and consistent positive gradient is evident across the groups: teachers with high PD exposure recorded the highest mean transformative pedagogy score ($M = 72.4$, $SD = 11.2$), followed by those with moderate PD exposure ($M = 64.8$, $SD = 12.6$), and those with low PD exposure recorded the lowest mean score ($M = 55.9$, $SD = 13.8$). The one-way ANOVA confirmed that these differences were statistically significant, $F(2, 197) = 18.42$, $p < .001$, with an eta squared value of $\eta^2 = .16$ indicating a large practical effect size. Post-hoc Tukey tests further confirmed that all pairwise group differences were statistically significant ($p < .05$), meaning that the differences in transformative pedagogy implementation between each pair of PD exposure groups, high versus moderate, high versus low, and moderate versus low, were all meaningful and not attributable to chance. These findings provide sufficient grounds for the rejection of the null hypothesis, confirming that professional development exposure is significantly associated with the adoption of transformative pedagogical practices. The null hypothesis (H_{01}) is therefore rejected.

Discussion of Findings

The findings of this study offer important empirical insights into the relationship between professional development and transformative pedagogy implementation in public secondary schools in Garki, FCT, Abuja. The study found that 78% of sampled teachers reported no participation in any formal professional development programme; this reflects a deeply entrenched systemic failure in teacher support structures within the FCT public secondary school system. This finding resonates with UNESCO's (2021) global assessment, which identified inadequate professional development provision as one of the most persistent barriers to ESD implementation in developing country contexts, while providing a sharply localised illustration of that global pattern that policymakers in the FCT cannot afford to overlook.

With respect to the implementation of transformative pedagogy, all five practice dimensions recorded moderate levels of implementation, with mean scores ranging from 2.5 to 3.2 on the five-point scale. While no dimension fell below the moderate threshold, the variation in scores across dimensions is nonetheless instructive. Collaborative learning ($M = 3.2$) and student-centred instruction ($M = 2.9$) recorded the stronger moderate scores, suggesting these dimensions are more consistently practised and more intuitively accessible to teachers within existing classroom structures. Critical thinking facilitation ($M = 2.7$), inquiry-based learning ($M = 2.6$), and reflective practice ($M = 2.5$), though still within the moderate range, recorded the weakest scores among the five dimensions, suggesting that these more cognitively demanding and philosophically complex aspects of transformative pedagogy remain the least developed in practice. This pattern is consistent with Fradale's (2024) observation that professional development programmes in resource-constrained contexts tend to facilitate surface-level engagement with transformative pedagogy rather than the deeper attitudinal and philosophical shifts that genuine transformation requires. The findings, therefore, suggest that while teachers have developed a foundational familiarity with transformative practices, the depth and consistency of implementation remain insufficient for the realisation of meaningful ESD outcomes.

The hypothesis testing results further strengthen these conclusions. The one-way ANOVA revealed a statistically significant difference in transformative pedagogy implementation across PD exposure levels, $F(2, 197) = 18.42, p < .001, \eta^2 = .16$, with post-hoc Tukey tests confirming that all pairwise group differences were significant. Teachers with higher levels of professional development exposure consistently demonstrated greater adoption of transformative pedagogical practices, affirming the central argument of this study that professional development is a critical driver of pedagogical transformation. This finding aligns with Pan (2023), who established that transformative learning is fundamentally dependent on structured, critically reflective processes most effectively cultivated through well-designed professional development programmes, and with MacLatchy et al. (2025), who similarly affirmed that meaningful professional development enhances teacher effectiveness and classroom innovation.

Collectively, these findings make a significant contribution to the field by providing empirical evidence on professional development access and transformative pedagogy implementation, specifically within Garki, FCT, Abuja. Practically, they suggest that educational authorities in the FCT must move beyond episodic workshops toward investing in continuous, context-responsive professional development ecosystems that provide the sustained mentorship, peer learning, and institutional encouragement necessary for all dimensions of transformative pedagogy, particularly reflective practice, inquiry-based learning, and critical thinking facilitation to move from moderate to high levels of implementation in everyday classroom practice.

Conclusion

This study concludes that professional development is a critical catalyst for implementing transformative pedagogy and integrating sustainability education in public secondary schools in Garki, FCT, Abuja. The study showed that teachers with greater exposure to quality professional development programmes demonstrated significantly higher engagement in learner-centred, innovative, and sustainability-oriented teaching practices, while the overwhelming majority of teachers, operating without access to any formal professional development, remained anchored in conventional, teacher-centred instructional methods inadequate for preparing students to navigate contemporary sustainability challenges. These findings carry substantial implications for both teaching practice and educational policy. At the classroom level, they underscore that transformative teaching is not an innate disposition but a professionally cultivated competency, one that requires deliberate, sustained, and institutionally supported development. At the policy level, they present a compelling case for reframing professional development not as a peripheral or occasional administrative exercise but as a foundational investment in the quality, equity, and sustainability of Nigeria's education system. For the Garki, FCT specifically and Nigeria more broadly, achieving the transformative educational outcomes envisioned by the Sustainable Development Goals, particularly SDG 4, will require systematic, policy-driven commitment to building robust professional development infrastructures that are continuous, context-responsive, and explicitly aligned with the principles of transformative pedagogy and Education for Sustainable Development.

Recommendations

1. **Investment in Teachers' Growth Through Quality Professional Development:** Education authorities should prioritise regular, well-structured professional development programmes focused on transformative and sustainability-focused pedagogy.
2. **Support Reflective and Inquiry-Based Teaching:** Professional development should include components that build teachers' capacity for critical thinking, reflective practice, and inquiry-based methods.
3. **Strengthen Institutional Support:** Schools should foster a culture of peer learning and administrative encouragement to sustain the impact of PD on teaching practices.
4. **Conduct Further Research:** Future studies should explore the long-term effects of professional development on transformative pedagogy and sustainable education practices.

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EVALUATING INCLUSIVITY IN ENTREPRENEURSHIP ESSENTIAL AND VOCATIONAL SKILLS PROGRAMMES IN DELTA STATE: IMPLICATIONS FOR SOCIOECONOMIC TRANSFORMATION AND SUSTAINABLE DEVELOPMENT

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Abstract

*As nations pursue the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 on inclusive and equitable quality education, the role of innovation and inclusivity in higher education has become increasingly vital. This study examines the extent to which entrepreneurship and vocational skills programmes in Delta State promote inclusivity and contribute to sustainable development through higher education frameworks. Focusing on state-sponsored initiatives such as the Skills Training and Entrepreneurship Programme (STEP), Youth Agricultural Entrepreneurs Programme (YAGEP), and the Graduate Employment Enhancement Programme (GEEP), the study explores whether access and outcomes differ across gender, age, location, and academic background. Grounded in Human Capital Theory, the Capability Approach, and Social Inclusion Theory, a descriptive ex post facto correlational design was employed. The population comprised graduate beneficiaries of YAGEP, STEP, and GEEP from five cohorts (2017–2022). Data were collected from 296 participants using a stratified random sampling technique. The research instrument, Entrepreneurship and Vocational Education Questionnaire (EVEQ), was validated by subject experts, with a reliability coefficient of 0.751. Descriptive statistics and chi-square tests were conducted using SPSS Version 27. Findings from multinomial logistic regression indicate that programme type is a significant predictor of employment outcomes, with participants in STEP ($Exp(B) = 14.05$, $*p* < .001$) and YAGEP ($Exp(B) = 19.82$, $*p* < .001$) significantly more likely to become entrepreneurs compared to GEEP participants. Similarly, STEP ($Exp(B) = 5.84$, $*p* = .001$) and YAGEP ($Exp(B) = 7.75$, $*p* = .001$) significantly increase the likelihood of paid employment. In contrast, gender, location, academic background, and age were not statistically significant predictors across employment categories, indicating outcome-level inclusivity. The study concludes that entrepreneurship programmes contribute meaningfully to employment and socioeconomic transformation, with programme design and structure, rather than participant characteristics, emerging as the primary drivers of success.*

Keywords: *Inclusivity, higher education, vocational skills, employment, sustainable development, entrepreneurship education*

Introduction

In an era of rising youth unemployment, poverty, and socioeconomic disparities, developing economies such as Nigeria have embraced entrepreneurship and vocational skills development to drive inclusive growth and advance the United Nations (UN) Sustainable Development Goals (SDGs) (UNESCO, 2016; United Nations, 2023). These efforts equip individuals with practical skills for labour markets while fostering innovation, productivity, and equitable resource distribution (World Bank, 2022). Inclusivity means integrating diverse groups by gender, location, education, and vulnerability, which ensures that marginalized populations benefit, enhancing outcomes and aligning with SDGs 1 (No Poverty), 4 (Quality Education), 8 (Decent Work and Economic Growth), and 10 (Reduced Inequalities) (Sen, 1999). Exclusionary practices, however, perpetuate marginalisation, weaken sustainability, and limit economic diversification in resource-dependent regions such as Nigeria's Niger Delta.

Delta State, a hydrocarbon-rich Niger Delta area, illustrates this shift amid oil revenue volatility and environmental degradation, affecting its youthful (81% aged 0–39) and rural (58.7%) population (Delta State Government, 2024). The Delta State Job and Wealth Creation Bureau launched initiatives like the Skills Training and Entrepreneurship Programme (STEP), Youth Agricultural Entrepreneurs Programme (YAGEP), and Graduate Employment Enhancement Programme (GEEP) (Delta State Government, 2022). Between 2015 and 2023, these programmes empowered over 7,000 beneficiaries through training in ICT, agriculture, construction, and business incubation, plus starter packs, micro-credit, and mentorship. STEP trained 5,051 youths (aged 18–35) in trades; YAGEP aided 1,776 rural agri-entrepreneurs via cluster farming; and GEEP offered internships to 120 graduates. Plans target 12,351 non-agricultural enterprises by 2027, aiming for 875,000 jobs, poverty reduction from 47% to 35%, and a boost in non-oil GDP to 52% (Delta State Government, 2024).

Yet, inclusivity levels determine sustainability. Barriers such as gender biases marginalizing women in rural economies, geographic inequalities limiting rural access (70% of agrarian youths), and scant support for persons with disabilities (PwDs) and low-literacy groups exclude 60–70% of eligible beneficiaries from accessing, participating in, and fully benefiting from the programmes (Okojie, 2021; Delta State Government, 2024). Recent steps include the Women Empowerment and Skills Acquisition Programme (WESAP) for 2,500 women's cooperatives and the Rural Youth Skills Acquisition (RYSA) programme, which trains 1,890 youths annually per district (Delta State Government, 2024). However, gaps persist: rural infrastructure receives one-third of urban allocations; YAGEP female enrolment is 36.7%. These widen inequalities, capping YAGEP's 41.7% income gains and hindering Medium-Term Development Plan targets such as 95% rural water access and 60% health coverage (Ighoroje & Omorogiuwa, 2021; National Bureau of Statistics, 2023; Delta State Job and Wealth Creation Bureau, 2023; Delta State Government, 2024).

This study assessed inclusivity in STEP, YAGEP, and GEEP, examining interactions of gender, rurality, disability, and educational access on parity, participation, and outcomes. It analyzes their role in poverty reduction, employment, and inequality mitigation, using beneficiary data and policies to recommend SDG-aligned enhancements for transformative development in Delta State.

Statement of the Problem

Despite significant government investment in youth skills acquisition and entrepreneurship programmes in Delta State, concerns persist regarding their inclusivity and equitable reach. Programmes such as STEP, YAGEP, and GEEP aim to reduce unemployment, enhance skills, and promote self-reliance. Yet, evidence suggests that 60–70% of eligible youth are excluded due to structural and socioeconomic barriers, representing substantial losses in potential labour force participation, income generation, and overall economic productivity.

Persistent gender disparities, particularly in agriculture and enterprise programmes, limit women's access to income-generating opportunities, constraining their contribution to economic development. Spatial inequalities further disadvantage rural youth, who face limited access to information, training centres, and programme infrastructure, despite higher levels of need. Additionally, persons with disabilities and individuals with low literacy levels are inadequately accommodated, as adaptive training and targeted inclusion strategies remain minimal. If these gaps persist, the programmes risk underperforming in employment generation, income improvement, and poverty reduction, undermining broader goals of economic diversification and inclusive growth. This study therefore examined the inclusivity of STEP, YAGEP, and GEEP in Delta State to identify gaps and propose strategies for more equitable and effective outcomes.

Objectives of the Study

The main objective is to evaluate the inclusivity and employment outcomes of entrepreneurship and vocational skills programmes in Delta State. Specific objectives are to:

1. Determine the extent to which socio-demographic characteristics (sex, academic background, programme type, age, and location) reflect inclusivity in participant selection.
2. Examine the statistical relationship between programme type (STEP, YAGEP, and GEEP) and employment status.
3. Assess whether gender influences employment status.
4. Investigate the relationship between location (urban or rural) and employment status.
5. Evaluate the relationship between academic background and employment status.
6. Analyze the relationship between age group and employment status.

Research Questions

1. To what extent do socio-demographic characteristics (sex, academic background, programme type, age, and location) reflect inclusivity in participant selection for entrepreneurship and vocational skills programmes in Delta State?
2. Is there a significant relationship between programme type (STEP, YAGEP, GEEP) and employment status?
3. Is there a significant relationship between gender and employment status?
4. Is there a significant relationship between location (urban or rural) and employment status?
5. Is there a significant relationship between academic background and employment status?
6. Is there a significant relationship between age group and employment status?

Literature Review

Conceptual Foundations of Inclusivity and Skills Development

Inclusivity in development programmes refers to the intentional design and implementation of interventions that ensure equitable access to opportunities, resources, and participation for all individuals, regardless of gender, socioeconomic status, education, or geographic location. It emphasizes the removal of structural barriers that disproportionately affect marginalized populations **such as** women, rural dwellers, persons with disabilities, and low-literacy groups (Sen, 1999; United Nations, 2023). In developing countries, inclusivity is widely recognized as a critical mechanism for reducing poverty, inequality, and social exclusion (Eregha & Mesagan, 2021).

Within the context of entrepreneurship and vocational education, inclusivity ensures equal access to training, finance, and productive opportunities. Entrepreneurship education

develops competencies such as innovation, business management, and risk-taking, while vocational training focuses on the acquisition of technical and practical skills relevant to labour market demands (OECD, 2018; UNESCO, 2016). In Delta State, programmes such as STEP, YAGEP, and GEEP integrate these components by providing training, mentorship, start-up support, and financial assistance aimed at enhancing self-employment and reducing unemployment. However, the extent to which these programmes achieve equitable participation remains a key concern.

Socioeconomic transformation refers to sustained improvements in employment, income, and living standards driven by investments in human capital and inclusive development strategies (UNDP, 2023; World Bank, 2022). Inclusive participation ensures that the benefits of development programmes are widely distributed rather than concentrated among advantaged groups. This aligns with the broader concept of sustainable development, which integrates economic growth, social equity, and environmental sustainability (Brundtland Commission, 1987; United Nations, 2023). In this regard, inclusive entrepreneurship and vocational programmes play a vital role in promoting poverty reduction, employment generation, and economic diversification.

Theoretical Framework

This study integrates Human Capital Theory, Social Inclusion Theory, the Sustainable Livelihoods Framework (SLF), and the Capability Approach to explain how inclusivity shapes access, participation, and socioeconomic outcomes. Human Capital Theory asserts that education and skills development enhance productivity and employability (Becker, 1964), but unequal access limits these benefits. Social Inclusion Theory highlights the removal of economic, social, and institutional barriers that hinder participation, especially across gender and geographic lines (Levitas et al., 2007; Silver, 1994). The SLF emphasizes how individuals combine human, financial, social, physical, and natural assets to sustain livelihoods, while entrepreneurship and vocational programmes strengthen these assets, though unequal access can reduce their effectiveness (DFID, 1999). The Capability Approach stresses that access alone is insufficient; individuals must be able to convert acquired skills into meaningful outcomes within enabling environments (Nussbaum, 2000; Sen, 1999).

Empirical Review

Empirical evidence from Nigeria indicates that entrepreneurship and vocational training programmes contribute to improved employability, income generation, and business creation. However, these benefits are unevenly distributed across demographic groups. Studies have shown that participation and outcomes vary significantly by gender, location, and educational attainment (Nwachukwu & Ojo, 2017; Odigbo et al., 2020). Gender disparities persist, with male participation often exceeding female enrolment, particularly in agriculture-based and enterprise-driven programmes. Similarly, rural populations face structural barriers such as limited access to information, infrastructure, and training facilities, resulting in lower participation rates despite higher levels of need (Eregha & Mesagan, 2021).

In Delta State, programmes such as STEP, YAGEP, and GEEP have demonstrated success in promoting self-employment and income growth. However, their overall impact is constrained by persistent inclusivity challenges, including limited rural outreach, gender imbalance, and inadequate support for vulnerable groups. Evidence further suggests that programmes incorporating inclusive design features – such as targeted outreach, flexible training delivery, and support mechanisms for disadvantaged populations – help achieve more equitable and sustainable outcomes (Okoh & Ugoani, 2021; Olawale & Ayodele, 2023).

Gap in the Literature

Existing studies rarely examine inclusivity as a driver of programme effectiveness in Delta State and often overlook demographic differences in participation and outcomes. They also lack strong theoretical integration linking inclusivity to employability. This study addresses these gaps through a theory-driven, multivariate analysis of STEP, YAGEP, and GEEP, showing that programme type, not participant characteristics, drives employment outcomes.

Methodology

Research Design

A descriptive correlational research design was adopted to examine the relationships among programme participation, skill acquisition, employability readiness, and employment status. This design allowed for the description of participant characteristics and the examination of associations between variables.

Population and Sample

The population comprised graduate beneficiaries of YAGEP, STEP, and GEEP from five cohorts (2017–2022). The total population across all cohorts was 1,773 participants. A stratified random sampling technique was used to select 296 participants, proportionate to cohort sizes.

Table 3.1: Sample Distribution by Programme Cycle

Cohort	Population	Sample
2017–2018	298	53
2018–2019	380	76
2019–2020	318	59
2020–2021	401	76
2021–2022	376	69
Total	1,773	296

Instrumentation

Content validity was established through expert review by the two supervisors, two entrepreneurship education lecturers, one psychometrician, and one programme coordinator. The experts assessed item clarity, relevance, and alignment with the research questions and hypotheses. Revisions were made based on their feedback, ensuring the instrument adequately captured the constructs of engagement, skills acquisition, readiness, and status. Face validity was confirmed during the pilot, with 90% of participants finding items clear and unambiguous.

Reliability of the Instrument: A pilot study was conducted with 30 participants from a non-sampled cohort of YAGEP, STEP, and GEEP. Cronbach's alpha was used to assess internal consistency because the items were not all on the same scale. Some items used Likert scales, multiple choice, checklists, categorical yes/no items, and attribution questions, with an acceptable threshold of $\alpha \geq 0.70$. Separate reliability scores were also calculated for the essential skills scale, vocational skills scale, and employability readiness scale.

The computed reliability indices for the Entrepreneurship and Vocational Education Questionnaire (EVEQ) are as follows: Engagement subscale ($\alpha = 0.820$), Essential entrepreneurship skills subscale ($\alpha = 0.795$), Vocational entrepreneurship skills subscale ($\alpha = 0.922$), Employability readiness subscale ($\alpha = 0.713$), Employment status subscale ($\alpha = 0.785$),

and overall instrument ($\alpha = 0.701$). These values indicate acceptable to high internal consistency, supporting the instrument's suitability for the main study.

Data Collection and Analysis

Data were collected through direct administration of the questionnaire to participants. Descriptive statistics (frequencies, percentages) were used to summarize participant characteristics. Chi-square tests of independence were conducted to examine bivariate relationships. Multinomial logistic regression was employed to determine the predictive power of programme type and demographic variables on employment status, with employment status (unemployed, underemployed, paid employment, entrepreneur) as the dependent variable. All analyses were conducted using SPSS Version 27.

Results

Research Question 1: *To What Extent Do the Socio-Demographic Characteristics of Sex, Academic Background, Programme Type, and Residential Location Reflect Inclusivity in the Selection of Participants for Entrepreneurship and Vocational Skills Programmes in Delta State?*

Table 1: Key Distributions and Inclusivity Insights

Characteristic	Key Distribution (Frequency/Percent)	Chi-Square Test (*p*-value)	Inclusivity Assessment
Sex	Male: 162 (54.7%); Female: 134 (45.3%)	*p* = .104 (ns)	Near gender parity with no significant deviation from 50:50, indicating strong inclusivity.
Academic Background	Sciences: 35 (11.8%); Social Sciences: 55 (18.6%); Arts: 63 (21.3%); Engineering: 49 (16.6%); Agricultural Sciences: 94 (31.8%)	*p* < .001 (sig.)	Broad disciplinary representation but significant deviation from equal shares, suggesting some bias toward agricultural sciences despite overall diversity.
Programme Type	GEEP: 40 (13.5%); STEP: 162 (54.7%); YAGEP: 94 (31.8%)	*p* < .001 (sig.)	All programmes included, but significant unevenness (STEP dominance) reflects imbalanced access.
Residential Location	Urban: 187 (63.2%); Rural: 109 (36.8%)	*p* < .001 (sig.)	Significant urban skew highlights need for enhanced rural outreach to improve geographic inclusivity.
Age Group	20–25: 194 (65.5%); 25–30: 42 (14.2%); 30–35: 60 (20.3%)	*p* < .001 (sig.)	Significant youth skew (especially 20–25) aligns with programme goals for

Characteristic	Key (Frequency/Percent)	Distribution	Chi-Square Test (*p*-value)	Inclusivity Assessment
				recent graduates but limits age inclusivity for older participants; extension to 35 provides some flexibility.

Source: Researcher (2024)

Overall, selections promote inclusivity primarily in gender, while statistical tests confirm opportunities for greater equity in other dimensions through targeted adjustments to reduce significant deviations from uniformity.

Research Question 2: *Is There a Significant Relationship Between Programme Type (STEP, YAGEP, GEEP) and Employment Status?*

Table 2: Cross-Tabulation of Programme Type and Employment Status

Programme	Unemployed	Underemployed	Paid Employment	Entrepreneur	Total
GEEP	4	8	25	3	40
STEP	4	21	61	76	162
YAGEP	1	6	34	53	94
Total	9	35	120	132	296

Source: Researcher (2024)

YAGEP and STEP show high entrepreneurship rates, while GEEP favours paid employment. The chi-square result ($\chi^2 = 33.547, p < .001$) and regression findings (STEP: **B = 1.764, p = .001**; **B = 2.642, p < .001**; YAGEP: **B = 2.048, p = .001**; **B = 2.987, p < .001**), see Table 7; confirm a significant association, indicating that programme type strongly influences employment outcomes.

Research Question 3: Is There a Significant Relationship Between Gender and Employment Status?

Table 3: Cross-Tabulation of Gender and Employment Status

Sex	Unemployed	Underemployed	Paid Employment	Entrepreneur	Total
Male	4	21	69	68	162
Female	5	14	51	64	134
Total	9	35	120	132	296

Source: Researcher (2024)

Females show slightly higher entrepreneurship and males higher paid employment, but both chi-square ($\chi^2 = 1.699, p = .637$) and regression results (e.g., Paid employment: $B = -0.148, p = .731$; Entrepreneurship: $B = -0.102, p = .820$), see Table 7; indicate no significant association, meaning gender does not influence employment outcomes.

Research Question 4: Is There a Significant Relationship Between Location (Urban or Rural) and Employment Status?

Table 4: Cross-Tabulation of Location and Employment Status

Location	Unemployed	Underemployed	Paid Employment	Entrepreneur	Total
Urban	6	19	79	83	187
Rural	3	16	41	49	109
Total	9	35	120	132	296

Source: Researcher (2024)

Employment outcomes are similar across urban and rural participants, with no significant association ($\chi^2 = 1.605, p = .658$). Regression results (e.g., Paid employment: $B = 0.274, p = .330$; Entrepreneurship: $B = 0.205, p = .489$), see Table 7; confirm that location does not significantly influence employment outcomes.

Research Question 5: Is There a Significant Relationship Between Academic Background and Employment Status?

Table 5: Cross-Tabulation of Academic Background and Employment Status

Academic Background	Unemployed	Underemployed	Paid Employment	Entrepreneur	Total
Sciences	1	9	9	16	35
Social Science	1	3	25	26	55
Arts	2	8	23	30	63
Engineering	1	6	21	21	49

Academic Background	Unemployed	Underemployed	Paid Employment	Entrepreneur	Total
Agricultural Science	4	9	42	39	94
Total	9	35	120	132	296

Source: Researcher (2024)

Employment outcomes vary slightly across disciplines, but both chi-square ($\chi^2 = 12.353$, $p = .416$) and regression results (e.g., Sciences: $B = -0.401$, Social Sciences: $B = 0.511$, Arts: $B = 0.472$, Engineering: $B = 0.451$, all $p > .05$), see Table 7; show no significant association, indicating that academic background does not influence employment status.

Research Question 6: *Is There a Significant Relationship Between Age Group and Employment Status?*

Table 6: Cross-Tabulation of Age Group and Employment Status

Age Group	Unemployed	Underemployed	Paid Employment	Entrepreneur	Total
20 to 25	8	25	77	84	194
25 to 30	1	2	14	25	42
30 to 35	0	8	29	23	60
Total	9	35	120	132	296

Source: Researcher (2024)

The 20–25 group shows strong employment outcomes, while 25–30 has the highest entrepreneurship rate. However, both chi-square ($\chi^2 = 8.876$, $p = .181$) and regression results (e.g., 20–25: $B = -0.591$, $p = .327$; 25–30: $B = 0.302$, $p = .662$), see Table 7; indicate that age is not a significant predictor of employment outcomes.

Table 7: Multinomial Logistic Regression Predicting Employment Status from Programme Type, Gender, Location, Academic Background, and Age Group ($N = 296$)

Predictor	<i>B</i>	<i>SE</i>	Wald	* <i>p</i> *	Exp(<i>B</i>)
Paid Employment vs. Unemployed					
Male	-0.148	0.433	0.12	.731	0.86
Urban	0.274	0.281	0.95	.330	1.32
Age 20–25	-0.591	0.602	0.96	.327	0.55
Age 25–30	0.302	0.688	0.19	.662	1.35
Sciences	-0.401	0.742	0.29	.589	0.67

Predictor	<i>B</i>	<i>SE</i>	Wald	*<i>p</i>*	Exp(<i>B</i>)
Social Science	0.511	0.661	0.60	.438	1.67
Arts	0.472	0.648	0.53	.468	1.60
Engineering	0.451	0.673	0.45	.503	1.57
STEP	1.764	0.521	11.45	.001	5.84
YAGEP	2.048	0.609	11.31	.001	7.75
Entrepreneur vs. Unemployed					
Male	-0.102	0.449	0.05	.820	0.90
Urban	0.205	0.296	0.48	.489	1.23
Age 20–25	-0.486	0.628	0.60	.439	0.62
Age 25–30	0.421	0.719	0.34	.559	1.52
Sciences	-0.352	0.768	0.21	.648	0.70
Social Science	0.584	0.689	0.72	.397	1.79
Arts	0.553	0.671	0.68	.410	1.74
Engineering	0.528	0.695	0.58	.447	1.70
STEP	2.642	0.534	24.50	< .001	14.05
YAGEP	2.987	0.621	23.12	< .001	19.82
Underemployed vs. Unemployed					
Male	0.201	0.416	0.23	.632	1.22
Urban	0.131	0.271	0.23	.633	1.14
Age 20–25	0.219	0.574	0.15	.699	1.24
Age 25–30	0.284	0.662	0.18	.674	1.33
Sciences	0.207	0.711	0.08	.771	1.23
Social Science	0.289	0.639	0.20	.655	1.34
Arts	0.276	0.623	0.20	.655	1.32
Engineering	0.251	0.652	0.15	.703	1.29

Predictor	<i>B</i>	<i>SE</i>	Wald	* <i>p</i> *	Exp(<i>B</i>)
STEP	1.132	0.496	5.20	.023	3.10
YAGEP	0.998	0.571	3.05	.081	2.71

Note. Reference categories: GEEP for programme type, female for gender, rural for location, Agricultural Science for academic background, and age 30–35 for age group. Model fitting information: $-2 \text{ Log Likelihood} = 405.72$, $\chi^2(24) = 52.84$, $*p < .001$. Pseudo R^2 : Cox and Snell = .336, Nagelkerke = .382.

The combined multinomial logistic regression model revealed that programme type was the only consistent and statistically significant predictor of employment status across all outcome categories. Participants in STEP and YAGEP were significantly more likely to be in paid employment or self-employment compared to those in GEEP. In contrast, gender, location, age group, and academic background did not significantly predict employment outcomes when considered alongside programme type. This indicates that previously observed differences in bivariate analyses were not robust under multivariate conditions. The model explained a substantial proportion of variance in employment status (Nagelkerke $R^2 = .382$), highlighting that structured programme design and content are more critical determinants of employment outcomes than demographic characteristics.

Discussion of the Findings

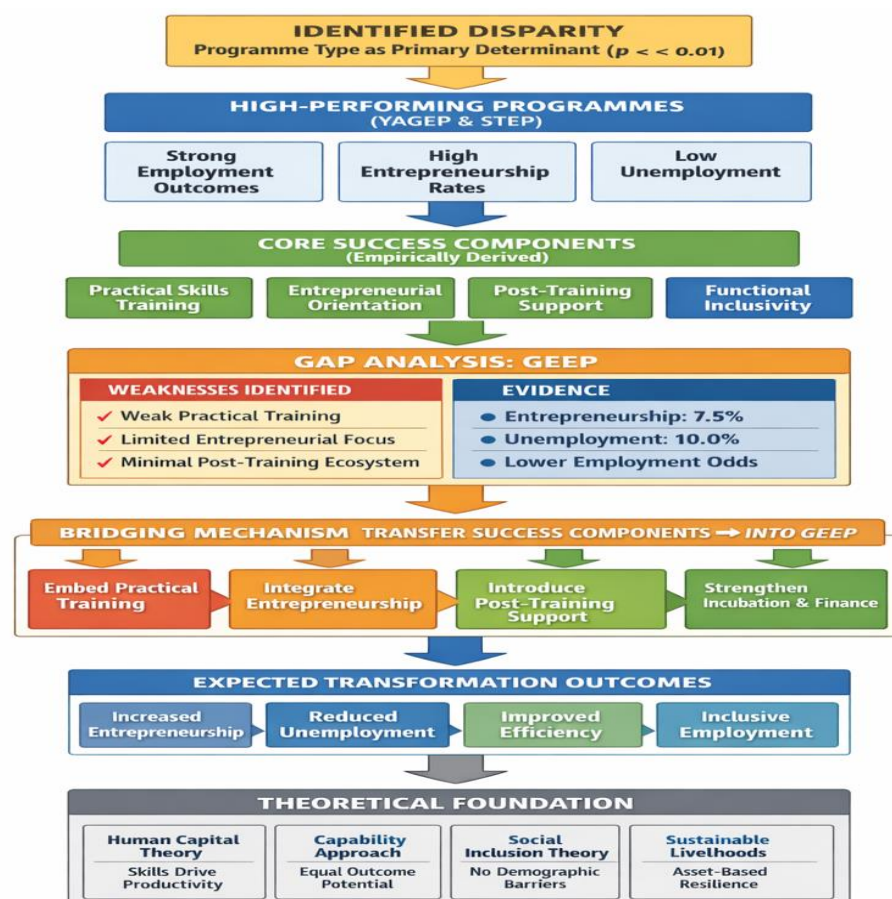
This study examined the inclusivity and effectiveness of entrepreneurship and vocational skills programmes in Delta State, Nigeria, with particular attention to the role of socio-demographic characteristics and programme type in shaping employment outcomes. Overall, the findings indicate that the programmes achieved moderate inclusivity. There was near gender balance among participants (55% male, 45% female), alongside representation from diverse academic backgrounds and age groups up to 35 years. However, urban participants constituted a larger proportion (63.2%), suggesting persistent limitations in rural outreach. This pattern aligns with previous studies that identified infrastructural and transportation barriers as key constraints to rural participation (Nwachukwu & Ojo, 2017; Eregha & Mesagan, 2021).

The study identified an “inclusivity paradox,” where entrepreneurship programmes achieve equity in employment outcomes despite clear inequalities in participation. Although descriptive results reveal significant demographic imbalances, especially an urban bias, regression findings show that factors such as location, age, and academic background do not significantly affect employment outcomes once participants are enrolled. This indicates the presence of outcome inclusivity (conditional on participation), while access inclusivity remains uneven. The dominance of urban participants suggests an “urban advantage,” driven by better infrastructure, information access, and proximity to training centres, which may also shape employability readiness. Overall, the findings emphasise that inclusivity operates as a two-stage process and reinforce that programme architecture, rather than participant characteristics, is the key driver of outcomes, while geographic disparities in access remain a critical policy concern.

Programme type emerged as the strongest and most consistent predictor of employment outcomes. Participants in the Youth Agricultural Entrepreneurs Programme recorded the highest entrepreneurship rate (56.4%) and the lowest unemployment rate (1.1%). Similarly, participants in the Skills Training and Entrepreneurship Programme demonstrated a balanced

distribution between paid employment and self-employment. In contrast, participants in the Graduate Employment Enhancement Programme were predominantly engaged in paid employment (62.5%) with relatively low entrepreneurial outcomes. These results confirm that programme structure and content play a critical role in shaping employment trajectories. The findings support Human Capital Theory, which posits that structured skill acquisition enhances productivity and employability, and are consistent with earlier empirical studies highlighting the positive impacts of these programmes on income generation and labour market integration (Okoh & Ugoani, 2021; Olawale & Ayodele, 2023).

Based on the empirical results provided, the Inclusive Entrepreneurship and Vocational Education Framework was synthesized by the study. It highlights how the structural components of YAGEP and STEP drive superior entrepreneurship and employment outcomes compared to the gaps identified in GEEP. The Inclusive Entrepreneurship and Vocational Education Framework is an evidence-based model developed to explain and address the observed disparities in employment outcomes across entrepreneurship programmes in Delta State. The framework shows that programme structure, not participant characteristics, drives employment outcomes. Evidence with $p < .001$ confirms that the type and design of a programme determine success, not gender, age, or figure 1: The Inclusive Entrepreneurship and Vocational Education Framework background.



High-performing programmes (YAGEP and STEP) achieve strong employment and entrepreneurship outcomes because they include practical hands-on skills training, a strong entrepreneurial focus, post-training support (through mentorship, finance, and market access),

and functional inclusivity with equal outcomes across groups. In contrast, GEEP underperforms due to the absence of these elements, resulting in low entrepreneurship (7.5%) and higher unemployment.

Core finding – Inclusivity Paradox: Although all programmes are inclusive at entry, only YAGEP and STEP convert participation into meaningful employment outcomes. Inclusivity without strong programme design leads to weak results.

Framework implication: Effective reform should shift focus from participant selection to programme architecture, integrate YAGEP and STEP success elements into GEEP through a bridging mechanism, and expand access to rural areas through decentralized delivery.

Conclusion

The study assessed the inclusivity and effectiveness of STEP, YAGEP, and GEEP in Delta State. The findings indicate that the programmes are largely inclusive, although an urban bias persists. Importantly, programme type emerged as the only significant predictor of employment outcomes, while socio-demographic factors showed no significant effect when controlled. The results further confirm that well-structured programmes produce better employment outcomes, aligning with Human Capital, Sustainable Livelihoods, Capability, and Social Inclusion theories. Overall, entrepreneurship programmes enhance skills, expand opportunities, and promote economic inclusion, making them vital tools for income generation, inequality reduction, and broader socioeconomic development.

Recommendations

Based on the findings of this study, the following recommendations were made for policymakers and the Bureau:

1. Restructure GEEP to include hands-on training and mentorship for stronger self-employment outcomes.
2. Use longitudinal, disaggregated data to monitor and address urban–rural gaps.
3. Implement gender-sensitive measures such as flexible schedules and childcare support.
4. Build industry partnerships for internships and market linkages.
5. Increase rural funding through mobile training units and transport support.

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ENHANCING TEACHERS' PROFESSIONAL DEVELOPMENT FOR EDUCATIONAL TRANSFORMATION AND SUSTAINABLE DEVELOPMENT IN THE 21ST CENTURY

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Abstract

This paper examines the pivotal role of teachers in promoting educational transformation and sustainable development in the 21st century. It provides a comprehensive analysis of the concept of a teacher, identifying key professional qualities, categories of teachers in Nigeria, and their multifaceted roles within the education system. It also explores the importance of continuous professional development (CPD), a mechanism for enhancing teachers' pedagogical competencies, content knowledge, and overall effectiveness in the classroom. The paper further highlights persistent challenges faced by teachers, including inadequate working conditions, low levels of motivation, insufficient professional recognition, and shortages of qualified personnel, which impede the delivery of quality education. Drawing on both national and international studies, the paper offers evidence-based recommendations for strengthening teacher capacity, improving professional status, fostering teacher retention, and ensuring that professional development initiatives align with global best practices.

Keywords: *Teacher Quality, Professional Development, Sustainable Education, Teaching Profession, Nigeria*

Introduction

Education serves as a fundamental instrument for the development and promotion of a nation's cultural heritage. It is the social mechanism through which values, knowledge, and traditions are transmitted from one generation to another. However, for this process to be effective, it requires the active involvement of trained professionals, particularly teachers (Imasuen & Aibinuomo, 2022; Organisation for Economic Co-operation and Development [OECD], 2020; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2023). Teachers play a central role in translating educational policies into practice and driving educational transformation. As emphasised in the National Policy on Education, no education system can rise above the quality of its teachers (Federal Republic of Nigeria, 2014), a position further reinforced by global evidence highlighting teacher quality as the most significant school-based determinant of student achievement (World Bank, 2022; UNESCO, 2023).

In the 21st century, education systems are increasingly expected to respond to complex global challenges such as environmental sustainability, technological advancement, and social inequality. Consequently, the role of teachers has expanded beyond the mere transmission of knowledge to include the development of critical thinking, problem-solving skills, digital competence, and sustainability awareness among learners. This evolving responsibility necessitates continuous professional development (CPD), which equips teachers with the knowledge and skills required to remain effective in dynamic educational environments (OECD, 2020; Schleicher, 2020).

Traditionally, professional development for teachers was largely limited to short-term workshops and in-service training programmes. However, contemporary perspectives view

professional development as a continuous, structured, and practice-oriented process that supports long-term professional growth and improved instructional effectiveness (Darling-Hammond et al., 2020; UNESCO, 2023).

This paper, therefore, examines the concept of a teacher, the qualities of a good teacher, the categories of teachers in Nigerian schools, and the roles and responsibilities of teachers. It further explores continuous professional development programmes and the challenges facing the teaching profession in Nigeria in the context of achieving educational transformation and sustainable development.

The Concept of a Teacher

The term "teacher" has been defined in various ways by scholars and professional bodies. At its core, a teacher is someone who facilitates learning by imparting knowledge, skills, and values to learners. According to the Teachers' Registration Council of Nigeria (TRCN, 2020), a teacher is a legally registered individual certified to deliver instruction in educational settings. A teacher is a trained professional who facilitates learning by guiding, instructing, and supporting learners in the acquisition of knowledge, skills, values, and attitudes necessary for personal and societal development. This implies that teaching goes beyond the mere transmission of information; it involves shaping the intellectual, moral, and social development of learners within and beyond the classroom (Imasuen & Aibinuomo, 2022; UNESCO, 2023).

Julius Nyerere cited in Ishumi (2025), and Masinde et al. (2025) described teachers as the cornerstone of national development, emphasising their critical role in shaping young minds and instilling values essential for societal progress. This perspective remains relevant in contemporary educational discourse, as it is widely recognised that teachers play a central role in national development and serve as key drivers of human capital development and sustainable growth (World Bank, 2022; UNESCO, 2023).

In modern educational practice, a teacher is not only an instructor but also a facilitator, mentor, counsellor, and role model. Teachers are expected to create inclusive learning environments, adapt instructional strategies to meet diverse learners' needs, and integrate technology into teaching and learning processes (OECD, 2020; Schleicher, 2020). This expanded role reflects the increasing complexity of education in a rapidly changing world.

Furthermore, teachers are agents of change who contribute to the realisation of national and global educational goals, including the Sustainable Development Goals (SDGs), particularly Goal 4, which focuses on inclusive and equitable quality education. Their effectiveness significantly influences learners' academic achievement, attitudes towards learning, and overall development (UNESCO, 2023; World Bank, 2022). Therefore, a teacher can be seen as a dynamic professional whose responsibilities extend beyond classroom instruction to include fostering lifelong learning, promoting ethical values, and contributing to societal transformation.

Qualities of a Good Teacher

A good teacher possesses a combination of personal, professional, and pedagogical qualities that enhance effective teaching and learning. These qualities enable teachers to facilitate meaningful learning experiences, support diverse learners, and contribute to overall educational development (Darling-Hammond et al., 2020; UNESCO, 2023). One of the most important qualities of a good teacher is strong subject matter knowledge. Teachers must have a deep understanding of the content they teach in order to present concepts clearly, answer learners' questions effectively, and connect new knowledge to prior understanding. Content knowledge forms the foundation of effective teaching, as a teacher must not only understand what is being taught but also be able to transform and align it with pedagogical and curricular

goals (Copur-Gencturk & Tolar, 2025; Mahmoodi-Shahrebabaki & Oslund, 2024). This indicates that a teacher must possess a higher level of academic competence than the learners. Equally important is pedagogical competence, which involves the ability to use appropriate teaching methods, instructional strategies, and assessment techniques to meet learners' needs (OECD, 2020). Another essential quality is effective communication skills. As Noddings (2012) emphasises, communication is at the heart of meaningful teacher-student engagement. A good teacher communicates ideas clearly and engages learners through questioning, explanation, and feedback. This fosters active participation and enhances students' understanding. In addition, classroom management skills are crucial for maintaining an organised and conducive learning environment where students feel safe, respected, and motivated to learn.

A good teacher also demonstrates patience, empathy, and emotional intelligence. These attributes help in understanding individual differences among learners and in supporting students who may face academic or personal challenges. By showing care and respect, teachers build positive relationships that enhance learners' confidence and engagement. Furthermore, adaptability and creativity are key qualities in contemporary education. With the rapid advancement of technology and changing educational demands, teachers must be flexible in their teaching approaches and innovative in designing learning experiences. The integration of digital tools and resources into teaching has become increasingly important in promoting interactive and student-centred learning (Schleicher, 2020; UNESCO, 2023). As Fullan (2021) notes, embracing innovation is key to staying effective in a rapidly evolving educational environment.

Continuous learning is another defining characteristic of a good teacher. Effective teachers engage in continuous professional development (CPD) to update their knowledge and skills, ensuring that they remain relevant and effective in their practice. This commitment to lifelong learning reflects professionalism and dedication to improving student outcomes (Darling-Hammond et al., 2020). Finally, a good teacher serves as a role model, demonstrating ethical behaviour, discipline, and a positive attitude towards work and learning. Through their actions and interactions, teachers influence not only students' academic development but also their moral and social values.

Categories of Teachers in Nigerian Schools

In the Nigerian education system, teachers can be grouped into several categories based on their academic qualifications, pedagogical training, and professional status (Ofoegbu, 2004; Olorunsola & Alani, 2017; UNESCO, 2014). At the forefront are the qualified professional teachers, who have received formal education in teaching and possess relevant pedagogical training. These individuals are equipped with both subject knowledge and the instructional methodologies required to facilitate effective learning in the classroom (Imasuen & Aibinuomo, 2022; UNESCO, 2023).

Another category includes non-professional teachers, individuals who hold academic qualifications in fields outside of education but who find themselves employed in teaching positions. While they may be knowledgeable in their respective subject areas, they often lack formal training in pedagogy and classroom management, which limits their effectiveness in delivering the curriculum as intended (World Bank, 2022; OECD, 2020).

A third group consists of inadequately trained teachers. These individuals possess minimal or inadequate training in teaching methodologies and are often products of unregulated or substandard teacher preparation programmes. Their limited understanding of educational psychology, instructional strategies, and curriculum planning makes it difficult for them to meet the diverse learning needs of students (UNESCO, 2023).

The final group comprises para-teachers, also known as community or contract teachers. These individuals are typically recruited on an ad-hoc basis, particularly in underserved or rural areas, as a temporary solution to address teacher shortages (Kirk & MacDonald, 2001; UNESCO, 2014; Bold et al., 2017; Kingdon et al., 2013). Para-teachers often have limited formal training, which can affect instructional quality, but they play a critical role in maintaining access to education where professionally trained teachers are unavailable.

Roles and Responsibilities of Teachers

A teacher is a pivotal figure in the education system and the broader society. At the core of the teacher's function is the instructional role, which involves designing and delivering engaging and meaningful lessons that align with curriculum objectives and cater to the diverse needs of learners (Imasuen & Aibinuomo, 2022; UNESCO, 2023). In this capacity, teachers act as information providers and practical instructors who introduce students to new knowledge and skills in structured ways.

Teachers also serve a mentoring role, offering both academic guidance and emotional support to help students navigate personal and educational challenges. They act as counsellors and facilitators of learning, often identifying and nurturing the individual potential of their students. This mentoring function enhances emotional and attitudinal development, fostering maturity, resilience, and social competence in learners (OECD, 2020; Darling-Hammond et al., 2020).

Another central aspect of the teacher's responsibility is their assessment role. Teachers engage in both formative and summative assessments to monitor learners' progress, diagnose learning difficulties, and adjust their teaching strategies accordingly. Assessment plays a critical part in supporting and sustaining student achievement (Amadi et al., 2019; UNESCO, 2023). Through this, teachers also act as curriculum evaluators and assessors of learners' growth and performance.

In managing classrooms, teachers take on the classroom management role, where they create structured and supportive learning environments that promote discipline, mutual respect, and cooperation. An organised and peaceful classroom atmosphere is essential for productive learning, and this is largely dependent on the teacher's ability to manage time, resources, and behaviour effectively (OECD, 2020).

In today's rapidly evolving educational landscape, teachers are also required to assume an innovative role. They are expected to incorporate technology, creative strategies, and contemporary pedagogical techniques to enhance student engagement and learning outcomes. This role requires adaptability and continuous professional development to stay abreast of global educational trends (Fullan, 2021; Schleicher, 2020).

Beyond the classroom, teachers have a unique role in society. They shape not only the cognitive development of learners by promoting critical thinking, intellectual curiosity, and problem-solving skills, but also contribute significantly to emotional and ethical development. By modelling and instilling values such as integrity, honesty, empathy, and respect, teachers help to mould students into morally upright and socially responsible citizens (Imasuen & Aibinuomo, 2022; UNESCO, 2023).

Ultimately, a teacher is not only a planner, responsible for designing lessons and aligning them with curriculum frameworks, but also a developer of learning resources, a supervisor and organiser of instruction, and a role model whose conduct and professionalism set a standard for learners to emulate. Without the teacher, there would be a vacuum in the nurturing of human capital, professional competence, and ethical awareness, components essential to achieving sustainable national development (World Bank, 2022).

Continuous Professional Development Programmes in Equipping Teachers' Competence

Professional development (PD) of teachers is indispensable for providing quality education. Professional development practices help teachers improve their content-based pedagogical knowledge. It also pays attention to enhancing skills, practice, and self-motivated changes in education (Blandford, 2012; Darling-Hammond et al., 2020). The quality of education is considered one of the prime factors in determining quality in schools, as is evident from successful education systems around the world (Barber & Mourshed, 2007; OECD, 2020).

With reference to schools, quality education comprises a friendly learning environment, curriculum outcomes, student achievement, and availability of professionally trained teachers (UNICEF, 2000; UNESCO, 2023). Professionally competent teachers engage and equip themselves in a process of ongoing professional learning because such practices improve subject knowledge and pedagogical competence. The same view has been shared by Holmes, cited in Darling-Hammond et al. (2020), who argued that information undergoes constant change and teachers must continually update their professional knowledge to keep pace with global developments. This perspective is reinforced in international frameworks emphasising teacher lifelong learning (OECD, 2020; UNESCO, 2023). Therefore, a teacher is expected to practise the best professional skills to meet the demands of the profession (Cruickshank et al., cited in Darling-Hammond et al., 2020). Professional development ensures that teachers can respond effectively to evolving educational needs.

The Professional Development for Teachers

Education systems around the world are changing and introducing new methods. The need for schools to produce workers with 21st-century skills is a challenge that is confronting teachers. Therefore, the professional development of teachers, namely education and training to enhance teachers' knowledge and skills, has thus become a top priority (Darling-Hammond et al., 2020; OECD, 2020; UNESCO, 2023). To effectively foster students' development of 21st-century skills, teachers themselves must have at least a good command of these skills and be well prepared in their own capacity to impart such skills to students.

Therefore, it is essential that teacher professional development programmes equip teachers with the necessary skills to achieve the expectations of 21st-century education. Teacher development is the professional growth a teacher achieves as a result of gaining increased experience and examining his or her teaching systematically (Glatthorn, cited in Darling-Hammond et al., 2020; OECD, 2020). Haßler (2014) highlights that "teacher education" or "teacher professional development" is preferable to "teacher training". Teachers learn how to learn and how to put theory into practice to advance student development (Villegas-Reimers, cited in Darling-Hammond et al., 2020; UNESCO, 2023).

Ganser, cited in Darling-Hammond et al. (2020) and UNESCO (2023), posits that professional development includes formal experiences such as attending workshops and professional meetings, mentoring, and informal experiences. This conception of professional development is therefore broader than career development, which is defined as "the growth that occurs as the teacher moves through the professional career cycle" (Glatthorn, cited in Darling-Hammond et al., 2020; OECD, 2020), and broader than staff development, which is "the provision of organised in-service programmes designed to foster the growth of groups of teachers".

For a long period of time, the only form of professional development available to teachers was short-term "staff development" or in-service training, usually consisting of workshops or short courses that offered teachers new information on a particular aspect of their work. Only in recent years has professional development been considered a long-term process that includes regular opportunities and experiences planned systematically to promote growth

and development in the profession (Cohen, cited in Darling-Hammond et al., 2020; UNESCO, 2023). Based on the fact that teachers learn over time, it is perceived as a long-term process, resulting in a series of related experiences enabling teachers to relate prior knowledge to new experiences.

Challenges Facing the Teaching Profession in Nigeria

The teaching profession in Nigeria is confronted by a series of persistent and deeply rooted challenges that have significantly undermined its status, effectiveness, and appeal. These issues range from poor working conditions and low professional morale to systemic neglect and inadequate support from policymakers. Collectively, they have contributed to a growing disinterest in teaching and a high attrition rate among educators (Pressley et al., 2023; OECD, 2020; UNESCO, 2023).

One of the foremost challenges is the poor working environment in which many Nigerian teachers operate. Overcrowded classrooms, insufficient instructional materials, delayed or unpaid salaries, and dilapidated infrastructure characterise the daily realities of teaching in many schools (Akinbode et al., 2023; UNESCO, 2023). These conditions make effective teaching extremely difficult and discourage teachers from remaining committed to the profession.

Coupled with this is low motivation and job dissatisfaction, largely driven by poor remuneration, a lack of incentives, limited opportunities for career advancement, and the general undervaluation of teachers in society (Pressley et al., 2023; OECD, 2020; UNESCO, 2023). Another major concern is the lack of continuous professional development. In an era of rapidly evolving educational practices, many Nigerian teachers have little or no access to opportunities for retraining or acquiring new pedagogical techniques. This absence of lifelong learning impedes their growth and limits their capacity to adapt to modern teaching demands (Reychav et al., 2023; Darling-Hammond et al., 2020; UNESCO, 2023). These factors contribute significantly to high attrition rates within the teaching workforce. Many educators, overwhelmed by poor working conditions and systemic neglect, opt to leave the profession in search of more fulfilling and financially rewarding alternatives. This exodus results in a continual shortage of experienced teachers, especially in rural and underserved areas (Han & Hur, 2021; World Bank, 2022).

A further strain on the profession is the excessive workload teachers bear, often without commensurate compensation or institutional support. International research shows that excessive workload and long working hours are strongly associated with poorer wellbeing among teachers. In English-speaking countries, longer hours and task complexity have been linked to reduced workplace wellbeing and stress (Jerrim & Sims, 2021). Research also indicates that student misbehaviour and workload are significant stressors contributing to emotional exhaustion among teachers across different systems (Huang et al., 2024). In Bhutan, educators identify heavy workload, administrative duties, and limited professional voice as key contributors to occupational stress (Tasleem et al., 2023), while studies in Thailand report widespread burnout and wellbeing challenges among teachers related to prolonged work and job demands (Pakdee et al., 2025). In Nigeria, these challenges are further exacerbated by chronic underfunding and inadequate infrastructural support (Imasuen & Aibinuomo, 2022; World Bank, 2022). The result is a profession marked by burnout, regression, aggression, and eventual withdrawal. Poor conditions of service and inadequate welfare benefits have made the teaching profession unattractive to many.

Conclusion

A teacher plays a crucial role in the development of future leaders and professionals, and the advancement of any nation hinges on the quality of its education system. For a nation to thrive,

it must invest in education and support teachers to teach effectively. This requires qualified educators, adequate resources, and a professional commitment to ethical practices. As technology evolves, teachers must continuously develop their skills to remain relevant. Continuous professional development, mentoring, and training equip teachers to adapt to changing pedagogical approaches and prepare students for 21st-century challenges. Furthermore, government support at all levels is essential to ensure teacher satisfaction, retention, and the mentoring of new educators.

Recommendations

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

1. Schools and government agencies should design and implement long-term, structured CPD programmes that allow teachers to improve their skills continuously.
2. Classroom infrastructure, instructional resources, and welfare packages should be upgraded to motivate teachers and enhance their productivity.
3. Competitive remuneration, career progression opportunities, and recognition schemes should be introduced to retain qualified teachers and attract new talent.
4. Teachers should be trained and supported to incorporate technology and innovative teaching methods into the curriculum to meet 21st-century educational demands.
5. Educational policies must prioritise teacher professional development, ethical standards, and leadership support to ensure that teachers can perform optimally.

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PERCEIVED INFLUENCE OF INSTRUCTIONAL MATERIALS SUSTAINABILITY AND EFFECTIVE COMMUNICATION ON SECONDARY SCHOOLS' TEACHERS' PRODUCTIVITY IN KARU LGA, NASARAWA STATE

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Abstract

This study examined how instructional materials sustainability and effective communication influence teachers' productivity in secondary schools in Karu Local Government Area, Nasarawa State, Nigeria. Survey design was adopted, with a target population of 6,364 teachers across public and private schools, from which 145 respondents were selected using purposive and accidental sampling techniques. The study was guided by two research questions and one hypothesis: To what extent does instructional materials sustainability influence teachers' productivity? and the influence of effective communication on teachers' productivity? A self-structured questionnaire, validated by experts in department of Educational Foundations was used for data collection. The reliability was established through pilot testing with a Cronbach's Alpha coefficient of 0.75. Data were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics (independent t-test) at 0.05 significance level. Findings revealed that instructional materials sustainability significantly improves teachers' productivity by providing long-term resources for effective instruction. Similarly, effective communication enhances collaboration, reduces conflict, and fosters professional commitment among teachers, thereby promoting teachers' productivity. The study concludes that without materials sustainability and efficient communication, achieving transformative and sustainable education in Nigeria remains difficult. The paper recommends that education policymakers and administrators should: invest in sustaining instructional resources, strengthening participatory communication frameworks and providing continuous training for school administrators and teachers to use resources, in order to achieve transformation and sustainable development goal in Nigerian educational system.

Keywords: Teachers' Productivity, Instructional Materials Sustainability, Effective Communication, Educational Transformation

Introduction

Education plays a pivotal role in driving transformation and sustainable development. In Nigeria, teachers are central agents of this transformation, yet their productivity is largely influenced by the availability of instructional materials and the effectiveness of communication within schools. When teaching resources are inadequate or communication channels are weak, teachers struggle to deliver quality education, ultimately undermining broader developmental goals (UNESCO, 2020; Mbanefo, 2021). Teachers' productivity has often been constrained by inadequate instructional resources, poor communication frameworks, and limited professional support. These challenges hinder their ability to contribute effectively to educational transformation. The theme of this conference emphasizes the urgent need for rethinking educational management practices that empower teachers. Within this scope, Sub-theme 14 highlights resource sustainability and effective communication as crucial tools for achieving systemic improvement. In line with the conference theme, Innovative and Solution-Based Education for Transformation and Sustainable Development, and sub-theme 14, this paper

focuses on two key drivers of teachers' productivity: instructional materials sustenance and effective communication.

Secondary school teachers perceive instructional materials and effective communication as critical drivers of pedagogical success, strongly correlating with enhanced student learning, motivation, and improved classroom management. Sustained availability of these materials, coupled with effective communication, directly impacts teachers' ability to deliver lessons effectively. However, sustaining instructional materials in Nigeria is challenging due to issues like inadequate funding, a lack of consistent policy implementation, and disparities in resource distribution. Despite the efforts being made, through government initiatives at both federal and state levels to supply materials, promote teachers' professional development, and encourage improvisation to improve learning outcomes, there are still gap in teachers' productivity and educational quality (Odion, 2025). Consequently, effective communication in this context is the process by which the principals clearly conveying message while ensuring that the teachers understand it, and vice versa. It involves active listening, clarity in speaking and writing, and understanding the emotions and intentions behind the message. Thus, the key components include the sender, receiver, message, and feedback, all working together to ensure a clear and purposeful exchange of information for educational transformation. Effective communication, along with the use of instructional materials, helps teachers move to more interactive and engaging teaching styles. Proper management and sustained availability of resources also allow for more effective, consistent teaching, whereas lack of materials hinders productivity (Mbanefo, 2021). This study investigates the perceived influence of material sustainability and effective communication on teachers' productivity.

Statement of the Problem

Teachers remain the backbone of educational transformation, yet their productivity in Nigeria is often hampered by systemic challenges. One major issue is the inadequate provision and poor sustainability of instructional materials in many schools. Instructional materials such as textbooks, charts, laboratory equipment, and digital tools are either insufficient, outdated, or poorly maintained, forcing teachers to improvise in ways that compromise lesson delivery and student outcomes. Similarly, ineffective communication practices between school leaders and teachers frequently result in misunderstandings, lack of clarity in instructional goals, and limited teacher participation in decision-making processes. These challenges not only weaken teachers' morale but also reduce their productivity, which directly impacts student learning and the educational goals. In the context of sustainable development, this problem is critical because without effective teaching supported by sustainable resources and transparent communication, schools cannot produce the human capital needed for national growth. Sustainable development in education requires both material resources and strong professional collaboration. Therefore, investigating how sustainable instructional materials and effective communication can enhance teachers' productivity is essential for driving educational transformation in Nigeria and achieving long-term sustainability.

Purpose of the Study

The purpose of this study is to examine the perceived influence of instructional materials sustainability and effective communication on teachers' productivity for educational transformation in Karu Local Government Area, Nasarawa State. Specifically, the study seeks to:

1. Ascertain the extent sustainability of instructional materials influences teachers' productivity in Karu Local Government Area, Nasarawa State,
2. Investigate how effective communication impact on teachers' productivity in Karu Local Government Area, Nasarawa State.

Research Questions

The study addressed the following research questions and a hypothesis:

1. To what extent does instructional materials sustainability influences teachers' productivity in Karu Local Government Area, Nasarawa State?
2. What is the influence of effective communication on teachers' productivity in Karu Local Government Area, Nasarawa State?

Hypothesis (Ho1): There is no significant difference in the responses of the private and public teachers on the influence of communication on teachers' productivity.

Literature Review

Scholars have consistently shown that instructional materials and communication practices play a decisive role in teachers' productivity and commitment to educational transformation. Productivity describes the various measures of the efficiency of production, which is expressed as the ratio of output per unit of input used in a production process (Mbanefo, 2019). Adequate provision of instructional materials enables effective classroom delivery, minimizes the stress of improvisation, and enhances student learning outcomes (Achigaonye, 2019). Instructional materials are the tools and resources teachers use to support teaching and learning, from traditional textbooks to digital content, hands-on activities, and assessment tools. These materials, which include charts, videos, worksheets, and lesson plans, help convey information, make learning more engaging, and support diverse learning styles to achieve specific educational objectives. Conversely, the lack of sustainable instructional materials often leads to frustration, lower morale, and reduced productivity among teachers (Mbanefo, 2021).

Communication also plays a critical role in education: Effective communication between school leaders and teachers fosters collaboration, trust, and shared vision, which directly influences productivity (Ayeni & Akinola, 2020). Teachers who operate in environments where communication is participatory and transparent are more motivated and likely to align with institutional goals for transformation and sustainable development (as seen in Fig 1: Effective communication in work place, adopted from Spiceworks - <https://share.google/images/4F9x9opPx1YDdULVg>).



Effective Communication in Work Place

Mbanefo & Okolie (2022) stated that communication is a two-way process and an administration function that has accompanying elements, such as a sender, a message, a medium, a channel, a recipient, a reaction and criticism. However, for these components to work, there ought to be cooperation (collaboration) and understanding between the two parties involved. It is also essential for building strong relationships to school achieve objectives. Teachers' productivity is more than completing daily

teaching tasks; it involves enthusiasm, innovation, and contribution to educational transformation.

In this sense, sustainability refers to conserving resources, innovating to reduce waste, and ensuring equity of access to materials across schools. UNESCO (2020) emphasizes that sustainable education requires both adequate resources and collaborative processes to

transform learning environments. In terms of communication, Hallinger (2011) and Leithwood, Harris, and Hopkins (2020) argued that leaders who share information clearly, involve staff in decision-making, and establish feedback mechanisms create a culture of productivity and innovation. Participatory communication strategies strengthen teacher productivity by making teachers feel valued and recognized. Digital tools such as WhatsApp groups, email, and online learning platforms also enhance efficiency, transparency, and collaboration while reducing environmental costs associated with paper use (Selwyn, 2012). These communication strategies not only boost productivity but also support sustainable development through eco-friendly practices. Consequently, Billennium, Revolution Learning and Development Ltd, and The Open University gave the 7Cs of Effective communication, which are clear, concise, concrete, correct, coherent, complete, and courteous. This framework helps to ensure that your message is understood as intended by focusing on principles like being specific, to the point, and polite, as described in resources.

Theories provide deeper insight into how instructional materials and communication affect teachers' productivity, such as: Transformational Leadership Theory (Bass & Riggio, 2006) explains how school leaders can inspire teachers to go beyond routine tasks by sustaining resources, providing vision, and fostering open communication. Principals or administrators practicing transformational leadership demonstrate idealized influence through equitable resource allocation, inspirational motivation by communicating clear goals, and individualized consideration by listening to teachers' concerns. Similarly, Systems Theory by Von Bertalanffy in 1968 views the school as an interdependent unit where inputs (resources), processes (teaching and communication), and outputs (teacher and student performance) must be coordinated. Disruptions in communication or instructional resources weaken the entire system, making productivity and transformation unsustainable.

Empirical studies support these theoretical positions. Eze and Eze (2021) found that sustainable provision of teaching materials in Niger State significantly improved teachers' job satisfaction and commitment to classroom innovation. Ayeni and Akinola (2020) reported that effective communication strategies in Ondo State secondary schools enhanced teacher motivation and productivity. Mbanefo (2021), in her study of STEP-B projects in Nigeria, highlighted that sustainability in resource management is essential to long-term teacher effectiveness. Similarly, Ofojebe & Ezugoh (2010) demonstrated that when communication and resources were inadequate, teacher morale declined, leading to poor classroom engagement. These studies confirm that both sustainable instructional materials and communication strategies are fundamental to teacher productivity.

Despite these contributions, there remains a gap in explicitly linking instructional materials sustainability and effective communication to teachers' productivity within the framework of educational transformation. While previous studies have independently examined resource provision or communication, few have combined the two as dual levers of transformation. This study therefore fills the gap by exploring how the integration of instructional material sustainability and effective communication strategies can jointly influence teachers' productivity for educational transformation in Nigeria.

Methodology

The study employed a descriptive survey design, which was considered appropriate because it allows the researcher to gather data on teachers' opinions, attitudes, and experiences in a systematic manner without manipulating variables. This design also provided the opportunity to describe existing conditions and examine the influence of instructional materials sustainability and effective communication on teachers' productivity in the context of educational transformation.

The population of the study comprised 6,364 teachers across both public and private secondary schools in Karu Local Government Area, Nasarawa State. This large population reflects the diversity of teaching staff within the area and ensures that findings from the study are representative. From this population, a sample of 145 teachers was drawn using the purposive and accidental sampling techniques. These methods do not apply the principle of randomization and was adopted on the basis of the researcher's convenience and economy. The main instrument for data collection was a self-structured questionnaire titled: Questionnaire on Enhancing Teachers' Productivity through Instructional Materials Sustenance and Effective Communication (QETPIMSEC). The questionnaire was divided into sections covering respondents' demographic information, sustainability of instructional materials, communication strategies, and teachers' productivity.

To ensure validity, the instrument was subjected to expert review by specialists in the department of educational foundations who assessed the clarity, relevance, and coverage of the items. For reliability, the questionnaire was trial-tested with a small group of 15 teachers outside the study sample. The responses were analyzed using Cronbach's Alpha, which produced a coefficient of 0.75, indicating that the instrument had an acceptable level of internal consistency and could be reliably used for the study.

The data collection procedure involved the distribution of 150 copies of the questionnaire across the selected schools. Of these, 145 copies were properly filled and retrieved, representing a 96.7% return rate, which was considered adequate for analysis. The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics such as frequency counts, percentages, means, and standard deviations were employed to answer the research questions. The boundaries of the responses were calculated by dividing the serial width (4) by the number of responses (5) and were found to be 0.8. This was used to interpret the mean values. The acceptable boundaries for each response are: 0= 0.0 + 0.8 = 0.8 (Not applicable), 1= 0.8+ 0.8 = 1.6 (VLE, SD), 2= 1.6+ 0.6= 2.4 (LE, D), 3= 2.4 + 0.8= 3.2 (HE, A), 4= 3.2 + .8 = 4.0 (VHE, SA).

In addition, t-tests at 0.05 level of significance were used to test the hypotheses in order to determine whether significant differences existed in the responses of teachers regarding the influence of instructional materials sustainability and communication strategies on their productivity.

Results

Research questions 1: To what extent does instructional materials sustainability influence teachers' productivity in Karu Local Government Area, Nasarawa State?

Table 1 - Frequencies, Means and Standard Deviation of the responses of the respondents on the extent to which instructional materials sustenance enhances teachers' productivity for educational transformation
N=

S/N	Items	Frequency of the response Scores				\bar{x}	SD	Decision
		0	1	2	3			
1	To what extent does the sustenance of instructional materials improve teachers' instructional strategies and lesson delivery for educational transformation?	-	3	95	47	3.30	.504	VHE
2	To what extent does the maintenance of instructional materials improve	-	3	89	53	3.34	.519	VHE

	students learning outcomes for educational transformation?							
3	To what extent does the principals' adequate supervision of instructional materials improve teachers' effectiveness at work?	-	3	89	53	3.34	.519	VHE
Cluster						3.33	0.514	VHE

\bar{x} = Mean, SD = Standard Deviation, VHE = Very High Extent

Table 1 above showed the mean rating (\bar{x}) and the standard deviation (SD) of the responses of the participants on the extent to which principals' instructional materials sustenance enhance teachers' productivity for educational transformation. The analysis revealed that instructional materials sustenance enhances teachers' productivity to a very high extent. There are 3 items in the cluster and the grand mean is 3.33, which indicates that all the items enhance teachers' productivity to a high extent. The cluster standard deviation of 0.514 shows that the degree of variance from the mean is not much.

Research question 2 - What is the impact of effective communication on teachers' productivity in Karu Local Government Area, Nasarawa State?

Table 2 - Frequencies, Means and Standard Deviation of the responses of the respondents on the impact of effective communication on teachers' productivity N= 145

S/N	Items	Frequency of the response Scores					\bar{x}	SD	Decision
		0	1	2	3	4			
4	A well-planned communication channel helps the principal to collaborate effectively with teachers for improve productivity.	-			82	63	3.43	.497	S.A
5	Proper communication enhances teachers' productivity as the teacher are properly informed about the missions and visions of the principal/school	-			110	35	3.24	.429	S.A
6	Principals' holding of statutory and special meetings promotes good inter-personal relationship for collaboration and this enhances teachers' productivity	-		5	79	61	3.39	.555	S.A
7	Promotion of school community relationship by the principal motivates the teachers to be more effective in lesson delivery.	-		4	85	56	3.36	.536	S.A
Cluster						3.35	.504		

\bar{x} = Mean, SD = Standard Deviation, SA = Strongly Agree, A = Agree, SD = Strongly Disagree

Table 2 above shows the responses of the respondents is the impact of effective communication on teachers' productivity for educational transformation. The cluster mean of 3.35 indicates that the respondents strongly agreed that the effective communication impact on teachers'

productivity. The cluster standard deviation of 0.504, also indicates that there is not much deviation from the mean.

Hypothesis (Ho1): There is no significant difference in the responses of the private and public teachers on the impact of communication on teachers' productivity.

Table 3: Group's Means, Standard Deviation and t-test on Hypothesis

S/N	Items	GP	\bar{x}	SD	t-Cal	p-Value	Decision
4	A well-planned communication channel helps the principal to collaborate effectively with teachers for academic support	85	3.44	.499	.023	.981	NS
		60	3.43	.500			
5	Proper communication enhances teachers' productivity as the teacher are properly informed about the missions and visions of the principal/ school	85	3.24	.427	-.202	.840	NS
		60	3.25	.437			
6	Principals' holding of statutory and special meetings promotes good inter- personal relationship for collaboration and this enhances teachers' productivity	85	3.35	.592	-.858	.392	NS
		60	3.43	.500			
7	Promotion of school community relationship by the principal motivates the teachers to be more effective	85	3.32	.561	-	.275	NS
		60	3.42	.497			

GP= Group (P=85, P=60), \bar{x} = Mean, SD= Standard deviation, DF= 143, K= 0.05 level of significant.

Table 3 above showed the groups' means, standard deviation and t-test on Hypothesis. It reveals that the difference between the mean rating of the public and private schools are not significant. The result is confirmed by the P-values of .981, .840, .392 and .275 which are greater than 0.05 probability value. Hence the study accepts the null hypothesis and concluded that there is no significance difference in the response of the public and private schools' teachers regarding the impact of communication on teachers' productivity in secondary schools in Karu Local Government Area of Nasarawa State.

Discussion on Findings

Research question one sought the extent instructional materials sustenance enhance teachers' productivity for educational transformation. The result of the study showed that instructional materials sustenance can enhance teachers' productivity for educational transformation to a very high extent: by improving, teachers' instructional strategies, improving students learning outcomes. This is in line with Achigaonye, (2019) who stated that adequate provision of instructional materials enables effective classroom delivery and enhances student learning outcomes. It also revealed that adequate supervision of the instructional materials improves teachers' effectiveness at work. This aligns with Mbanefo (2021) who stated that sustainability of resources is a key determinant of long-term educational outcomes, thus, reinforcing the relevance of resource management.

Research question two sought the impact of effective communication on teachers' productivity for educational transformation. The result revealed that effective communication impact on teachers' productivity by: helping the principal to collaborate effectively with teachers to improve their productivity, as the teachers are properly informed about the missions and visions of the principal/ school. This is in line with Mbanefo and Okolie (2022) who stated that communication is also essential for building strong relationships to school achieve objectives. It also showed that effective communication promotes good inter-personal relationship for collaboration and motivates the teachers to be more effective in instructional delivery. This is also in line Ofojebe & Ezugoh (2010) who confirmed that both sustainable instructional materials and communication strategies are fundamental to teacher productivity. Comparing public and private school teachers' mean responses, the study revealed that while private schools tend to adopt faster digital communication tools, public schools benefit more from face-to-face participatory meetings. Both approaches improved productivity when effectively managed.

Conclusion

This study showed that teacher productivity is not only a function of individual effort or competence, but a systemic support in the form of resource sustainability and communication. This means that investments in education must go beyond infrastructure to include maintenance systems for instructional materials and the institutionalization of participatory communication frameworks, that require active involvement of teachers in sustaining resources and maintaining collaborative communication. The findings concludes that educational transformation in Nigeria cannot be achieved solely through curriculum reforms or teacher training; rather, it requires systemic attention to how resources are managed and how information flows within schools.

Recommendations

The following recommendations were made based on the findings of this study:

1. Instructional materials sustainability should be prioritised by education stakeholders/ government to enhance teachers' productivity.
2. Training programmes on participatory communication should be emphasized to strengthen collaborative communication in schools.
3. Further research should be conducted on sustainable instructional leadership practices and their long-term effects on teacher productivity and educational transformation.

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STRENGTHENING HOME-SCHOOL PARTNERSHIP FOR SUSTAINABLE EARLY LEARNERS' HEALTH AND LEARNING OUTCOMES IN EGOR LOCAL GOVERNMENT AREA, EDO STATE

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Abstract

The study examined the influence of strengthening home-school partnerships for sustainable learning outcomes and health of early learners. A descriptive survey design was utilised and the population consisted of teachers in private nursery/primary schools in Egor. The sample comprised 60 parents and 140 teachers. The research instrument was a questionnaire titled "Strengthening home-school partnership for sustainable early learners' health and learning outcomes questionnaire" validated by three lecturers in the Institute of Education. The Cronbach Alpha test of reliability was used to ascertain the internal consistency of the instrument, which yields a coefficient index of 0.87. The data were analysed with mean and standard deviation. The findings of the study revealed that strengthening home-school partnerships has positive influence on the learning outcomes of early learners to a high degree. Additionally, the findings showed that strengthening the home-school partnerships contribute to promoting sustainable health and well-being among early learners to a high degree. Lastly, the study indicated that home-school partnership to a high degree influences the social health of early learners. Consequently, it was recommended among others that the government should develop policies that enhance healthy active participation of parents in their children's education and health, and encourage schools to strengthen incorporation of parental engagement into their institutional policies framework.

Keywords: *strengthening home-school partnership, early learners, learning outcomes*

Introduction

Early childhood education plays a paramount role in children's development, later academic successes, and social-emotional growth. One of the ways of strengthening this crucial role is the establishment of stable and consistent home-school partnerships (Ngadni & Shuang, 2024). The home and schools are two key environments in a child's life, and the symbiotic association between these environments has significant impact on learning outcomes, motivation, and children's general well-being (Paccaud, Keller, Luder, Pastore & Kunz 2021). Productive family-school partnerships are hinged on the idea that families regardless of their social status can render support for their children's learning and development. Therefore, parents and teachers have the shared responsibility for fostering and educating children (Albright, Weissberg & Dusenbury, 2011). Partnership of the home through parental involvement and increased participation has been acknowledged to facilitate improvement in reading and math achievement in early years schooling (Galido & Sheldon, 2012). This outcome accentuates that a stronger and more supportive home-school linkages have the propensity of promoting healthy child development (Patrikakou & Weissberg, 2008). Consequently, effective partnerships create an opportunity for home and school to consolidate each other's strong points towards supporting learners, particularly children who are at edge of psychologically, emotionally, and behaviorally losing interest in learning (Anazia, Skinner &

Woods, 2025). Early childhood years epitomise a paramount phase in the physical, cognitive, and socio-emotional development of the school children. The developmental milestone attained during formative years, have substantial influence on their future outcomes. While there has been focus on other aspects of the children such as nutrition and physical activity, there are few in-depth understandings of the pivotal role of home-school relationships and their impact on child health.

In Nigeria, one of the core objectives of early childhood education, as specified in the national policy on education (Federal Republic of Nigeria [FRN], 2014), is to promote smooth transition of the child from home to school. However, this transition and sustainable early childhood education experience may be challenging in the absence of effective home-school collaborations. The term home-school partnerships have been described as a dynamic connection that exists among parents, teachers, and school heads, geared towards collectively creating an enabling learning atmosphere that supports child's development (Ngadni & Shuang, 2024). Parents' participation and partnerships in their children's education at basic schools level may be in form of rendering assistance in completing school assignment, project-based learning, encouraging independent study habits and nurturing self-discipline (Nweke, Anyachebelu & Mbach, 2020). Current research evidence remarked that collective effort in education, communication and information sharing, including collectively managing behavioural-related problems stand out as triad central areas of interest to parent-teacher partnerships (Anazia et al., 2025). An earlier survey acknowledged that one of veritable channel of conveying messages to parents as well as fostering meaningful parental engagement include the use of newsletters, memos, or personal notes from school among others (O'bryan, 2008).

Moreover, it has been asserted that meaningful learning cannot be accomplished in the absence of good health. The health and well-being of early learners' is hinged on the strength of home-school partnerships. When parents and teachers collaborate, a supportive environment emerges, promoting healthy behaviours, efficient health management, and overall development of the child. The World Health Organisation (2015) emphasises that reactivating efforts towards building strong school-community partnerships promotes health, education and development. Although several studies have investigated parental involvement and participation in their children's education, there remains a dearth of empirical evidence specifically focusing on the impact of strengthening home-school partnership for sustainable early learners' health and well-being, which form the fulcrum upon which all other learning activities are anchored. Therefore, conducting research into the impact of this partnership among preschool children will assist in gaining insight and a better understanding of how to improve the overall well-being and learning outcome of the early learners. Hence, the current study.

Statement of the Problem

Fruitful learning and overall development of early learners are dependent on the dynamic and cordial home-school relationship. The interactions between the home and school environments influences the health and well-being of early learners. While the significance of effective home-school partnership in promoting early learners' health has been acknowledged, empirical studies from Nigeria remains limited. In particular, there are dearth of in-depth studies focusing on the key components involved in creating a strong home-school relationship that supports early learners learning outcome and overall well-being. Consequently, it is imperative for an all-inclusive study that considers the influences of strengthening the interactions between these dual micro-environments which would culminate in sustainable learning outcome, health and well-being of preschool children. Bridging this knowledge gap, would further foster versatile connectivity empirical-based interventional strategies towards a better school experience for the young learners.

Research Questions

1. To what extent does strengthening the home-school partnership impact the learning outcomes of early learners in Egor?
2. To what extent would strengthening home-school partnerships and school influences the physical health of the early learners in Egor?
3. To what extent does strengthening home-school partnership influences the social health of the early learners in Egor?

Objective of the Study

The objective of the study was to investigate the influence of strengthening home-school partnership for sustainable early learners' health and learning outcomes in Egor Local Government Area, Edo State. Specifically, it seeks to find:

1. The extent to which strengthening home-school partnership impacts the learning outcomes of early learners in Egor Local Government Area.
2. The extent to which strengthening the partnership between home and school influences the physical health of the early learners in Egor Local Government Area.
3. The extent to which strengthening home-school partnership influences the social health of the early learners in Egor Local Government Area?

Methodology

The study adopted the descriptive survey research design. The population comprised all teachers and parents in one hundred and four (104) private registered nursery and primary schools in Egor (Edo State Basic Schools List, 2023). The sample comprised 200 respondents, comprising parents and teachers drawn from 20 private registered nurseries and primary schools through multi-stage techniques. The first stage involved selecting 20 private registered nursery and primary schools through a simple random sampling technique. In the second stage, utilizing simple random sampling, seven classroom teachers were drawn from the 20 private nursery and primary schools. Thus, a total of one hundred and forty (140) teachers were selected for the study.

In the third stage, three parents were drawn each from the twenty, using an accidental sampling technique. Consequently, sixty (60) parents were selected for the study. Therefore, two hundred (200) respondents were used for the study. The research instrument elicited responses on demographic data and contains fifteen (15) items, which elicited responses on the opinions of teachers and parents regarding strengthening home-school partnership for sustainable early learners' health and learning outcome. The questionnaire was a closed-ended item developed in four-point modified Likert scale format. The instrument was validated through expert judgments of Environmental Health and Safety Educator, Early Childhood Movement and Exploration specialist, and Educational Measurement. The reliability of the instrument was established through the administration of 20 copies of the questionnaire to three private schools outside Egor Local Government Area, which were not part of the sampled schools. However, they shared the same characteristics with the target population. A Cronbach Alpha test of reliability was used, yielding a reliability coefficient of 0.87, which is considered sufficient for the study. The data generated were analysed with descriptive statistics (Means and standard Deviations) using IBM SPSS version 23.

Results

Research question one: To what extent does strengthening the home–school partnership influence the learning outcomes of early learners in Egor?

Table 1: Influence of Strengthening Home–School Partnerships for Learning Outcomes of Early Learners

Items	Mean	Standard Deviation	Remarks
Strong relationship between home and school influences a child's education	3.65	0.50	Agree
Effective communication between parents and educators enhances a child's learning experience	3.58	0.58	Agree
A supportive home-school relationship contributes to a child's overall development.	3.55	0.58	Agree
When parents and educators care about a child's education, it boosts their self-esteem	3.56	0.57	Agree
Schools should include parents in decision making about the child's education	3.42	0.67	Agree
Cluster	17.70	1.89	

Table 1 shows that the respondents agree that strong relationship between home and school influences a child's education, effective communication between parents and educators enhances a child's learning experience, a supportive home-school relationship contributes to a child's overall development, when parents and educators care about a child's education, it boosts their self-esteem, and schools should include parents in decision making about the child's education. The cluster mean of 17.70 is an indication that strengthening home-school partnerships influences the learning outcomes of early learners to a high degree.

Research question two: To what extent would strengthening home-school partnerships and school influence the physical health of the early learners in Egor?

Table 2: The Extent to Which Strengthening Home-School Partnerships and School Influences the Physical Health of the Early Learners

Items	Mean	Standard Deviation	Remarks
A strong home-school connection boosts activities that improve a child's motor skills	3.35	0.58	Agree
Parents and educators helping the child to observe at least 10 hours sleep support physical health	3.23	0.65	Agree
Parents participation in school health activities benefits a child's physical well-being	3.30	0.71	Agree
Collaboration between parents and teachers is essential for promoting age-appropriate physical development	3.23	0.71	Agree
Promoting adequate nutrition, parents and teachers will help in the physical development of the child.	3.31	0.64	Agree
Cluster	16.43	.03	

Table 2 reveals that the respondents believed that a strong home-school connection boosts activities that improve a child's motor skills, parents and educators helping the child to observe at least 10 hours sleep support physical health, parents participation in school health activities benefits a child's physical well-being, collaboration between parents and teachers is essential for promoting age-appropriate physical development, and promoting adequate nutrition, parents and teachers will help in the physical development of the child. The cluster mean of 16.43 indicates that strengthening the home-school partnerships contribute to promoting sustainable health and well-being among early learners a high degree.

Research question three: To what extent does strengthening home-school partnership influences the social health of the early learners in Egor?

Table 3: The Extent to Which Strengthening Home-School Partnerships Influences Sustainable Social Health of the Early Learners

Items	Mean	Standard deviation	Remarks
When parents and teachers collaborate, the child learns to be respectful	3.31	0.65	Agree
Collaboration between home and school offers positive role model for a child to emulate	3.24	0.62	Agree
Collaboration between home and school foster positive peer relationships	3.11	.65	Agree
Regular support from home and school can boost a child's confidence and interactions	3.35	0.73	Agree
The synergy between home and school assist children in handling emotional and social challenges	3.39	0.66	Agree
Cluster	16.31	2.32	

Table 3 shows that the respondents were of the views that when parents and teachers collaborate, the child learns to be respectful and offers positive role model for a child to emulate. In addition, collaboration between home and school foster positive peer relationship, regular support from home and school can boosts a child's confidence and interactions, and the synergy between home and school assist children in handling emotional and social challenges. The cluster mean of 16.31 implies that strengthening the partnership between the home and school impacts the social health of the early learners to a high degree.

Discussion of Findings

This study aimed to investigate the influence of strengthening home-school partnership on the health and well-being of sustainable early learners in the early years. The findings revealed that strengthening home-school partnerships has significant influences the learning outcomes of early learners to a high degree. By implication, a robust relationship between the home and school is pivotal to child's education, support shared communication between parents and teachers including enhanced child's learning experience. These findings align with a previous study, which found that home and schools are dual micro-environments that are instrumental to the early learners learning outcomes, motivation, and overall well-being (Paccaud et al., 2021).

Additionally, the findings showed that strengthening the home-school partnerships contribute to promoting sustainable health and well-being among early learners a high degree. This finding aligns with Patrikakou and Weissberg (2008), whose study found that the

stronger and more supportive the connections between the home and school, the greater the likelihood of healthy child development.

Moreover, the findings revealed that strengthening the partnership between the home and school influences the social health of the early learners to a high degree. This finding corroborates Ngadni and Shuang (2024), who affirmed that home-school partnership is a dynamic relationship between parents, teachers, and school heads, aimed at jointly creating an enabling learning atmosphere that stimulates the child's development. It also supports earlier studies which demonstrated that parental involvement is positively linked with learning outcomes and social development (Wilder, 2014). It further lends credence to WHO (2015) which reiterated the need to re-energise efforts towards building strong school-community partnerships to promote health, education and development

Conclusion

In conclusion, it can be deduced from the study that strengthening the relationships between two micro-environments is paramount to a robust and all-inclusive learning atmosphere that supports the learning, health, and well-being of children.

Recommendations

The following recommendations were put forward:

1. The government and stakeholders in the educational sector should support and sustain policy implementation that promotes effective home-school partnerships. These include activities such as organising open day, parents-teachers interactive forum/platforms among others.
2. Schools should leverage on home-school partnership as a channels for promoting health messages such as educating parents on the need to promote health of the child through adequate meal, hygiene and sleep habits.
3. Parents should see the support and collaboration with their ward's school as a call to service which is for their interest and the child's overall benefits now and in the near future.

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EXPLORATION OF TEACHERS' AWARENESS AND ATTITUDE TOWARDS THE USE OF TELEMEDICINE FOR WELLNESS IN MARARABA, NASARAWA STATE

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Abstract

The integration of telemedicine into healthcare systems presents a promising avenue for promoting wellness through increased accessibility and efficiency. However, its successful adoption is influenced by users' awareness and attitudes, particularly among teachers, who often serve as community role models. This study explored the awareness and attitude of teachers towards the use of telemedicine for wellness in Mararaba. A descriptive survey design was adopted, involving 150 teachers selected through stratified random sampling from public and private schools. A structured questionnaire was administered to collect data on awareness levels, sources of information, perceived benefits, barriers and attitudes toward telemedicine utilization. Data were analyzed using descriptive statistics, as well as Chi-square tests were applied to examine relationships between demographic variables, awareness and attitude levels. The results revealed that 62% of the respondents were aware of telemedicine, while only 38% demonstrated a clear understanding of its practical use for wellness. Social media (40%), friends (12%) and the internet (10%) were the leading sources of information. Also, 71% of the teachers expressed a positive disposition towards using telemedicine for managing their health; however, concerns were raised about data privacy and insufficient user guidance. Significant associations ($p < 0.05$) were found between awareness levels and factors such as age, teaching experience and educational qualification. The study concludes that while awareness is moderate and attitudes are generally positive, there is a critical need for health promotion strategies and digital literacy initiatives. These efforts could empower teachers to utilize telemedicine more effectively for personal wellness.

Keywords: *Telemedicine, Teacher Awareness, Attitude, Wellness and Health Promotion*

Background of the Study

Telemedicine can be described as the delivery of healthcare services using Information and Communication Technologies (ICT). It has since emerged as a transformative tool for improving access to quality health services across diverse populations. Through virtual consultations, remote diagnostics, and digital health monitoring, telemedicine bridges geographical barriers, reduces waiting times, and enhances patient outcomes (Shiferaw et al., 2021). Its adoption has accelerated globally, particularly during the COVID-19 pandemic, where in-person consultations were limited.

The wellness of teachers, who constitute a critical segment of the workforce, is integral to sustaining quality education and fostering student development. Teachers often experience occupational stress, heavy workloads and inadequate access to healthcare, all of which may adversely affect their physical and mental well-being (Akinola & Adeyemi, 2020). Therefore, Ogunyemi & Oladipo (2020) asserted the need for teachers to have timely access to medical care so as to maintain a high level of productivity and educational outcomes because they are front-line contributors to human capital development. Enabling teachers to consult healthcare professionals without leaving their classrooms or communities reduces the time and cost associated with hospital visits (Gogia & Maeder, 2019). In rapidly urbanizing areas like

Mararaba, Nasarawa State, where population growth exerts pressure on existing health infrastructure, telemedicine could mitigate congestion in health facilities and improve wellness support for educators.

However, the effectiveness of telemedicine depends significantly on the awareness and attitude of potential users. Awareness encompasses knowledge about the existence, functionality, and benefits of telemedicine, while attitude reflects perceptions, willingness, and readiness to adopt such innovations. Low awareness or negative attitudes can hinder utilization even where telemedicine platforms are available. Studies conducted in other African countries have reported varying levels of awareness among teachers and other professionals. For example, research in Kenya and Ghana showed that although ICT use in education is relatively high, health-related applications remain poorly understood among teachers (Muthomi, 2020; Boateng & Effah, 2021). Similar findings in Nigeria indicate that professionals often associate telemedicine exclusively with emergency or specialized hospital settings rather than as a tool for everyday wellness (Adepoju et al., 2022).

In addition, teachers' attitudes toward telemedicine are shaped by factors such as perceived reliability, trust in digital health systems, prior experience with technology, and data privacy concerns (Eze et al., 2021). Positive attitudes have been linked to increased adoption rates in urban settings, while skepticism and fear of misdiagnosis limit use in rural or underserved areas (Ogunleye, 2023). Understanding these perceptions is crucial for designing targeted awareness campaigns and training programmes.

The socio-economic context of Mararaba presents unique considerations. The town serves as a peri-urban hub that attracts residents from both Nasarawa and the Federal Capital Territory. Rapid urbanization, population density, and infrastructural deficits have led to overburdened healthcare facilities, making teachers more vulnerable to delayed treatment and health deterioration (Emmanuel & Musa, 2021). In this environment, telemedicine could offer timely interventions, provided that teachers are informed and receptive.

Previous health technology studies in Nigeria have primarily focused on physicians' or patients' acceptance of telemedicine in tertiary hospitals (Ajayi, Abayomi & Ojo, 2013; Eze et al., 2021). Few have explored its relevance to occupational wellness, particularly among teachers at the primary or secondary levels. This gap in knowledge leaves policymakers with insufficient data to design programmes that promote teachers' well-being through digital health tools.

Moreover, government initiatives such as the National eHealth Strategy emphasize the importance of ICT in healthcare delivery (Federal Ministry of Health, 2016). Despite these policy frameworks, practical implementation at the grassroots level has been inconsistent. Understanding teachers' awareness and attitude toward telemedicine in Mararaba will provide insights into how such strategies can be localized and adapted to community needs.

Globally, there is growing recognition that occupational wellness programmes incorporating digital health solutions improve employee retention, productivity, and overall satisfaction (Zhang et al., 2022). Teachers in countries like India and Brazil have benefitted from mobile health (mHealth) applications that offer routine check-ups, counseling, and fitness monitoring (Rao et al., 2021). Investigating whether similar opportunities can be replicated in Nigeria is timely and relevant. The exploration of teachers' awareness and attitude toward telemedicine is not only an academic exercise but a practical necessity. If teachers in Mararaba demonstrate high awareness and positive attitudes, policymakers can leverage this readiness to introduce school-based telemedicine programmes. Conversely, if awareness is low or attitudes are negative, targeted sensitization, digital literacy training, and infrastructural investment will be required to foster adoption.

Furthermore, assessing teachers' knowledge and perception of telemedicine in Mararaba, Nasarawa State, aligns with broader efforts to improve access to healthcare through

ICT. This study aims to bridge the knowledge gap, guide local implementation of telemedicine programmes, and contribute to enhancing teacher wellness, a cornerstone of educational development and societal progress.

Research Objectives

1. To assess the level of awareness among teachers in Mararaba, Nasarawa State, regarding the concept and benefits of telemedicine for personal wellness.
2. To examine teachers' attitudes towards the use of telemedicine for health management, including their willingness to adopt it as part of their wellness practices.
3. To identify the major sources through which teachers receive information about telemedicine and determine how these sources influence their awareness.
4. To analyze the relationship between selected demographic variables (such as age, teaching experience, and educational qualification) and teachers' awareness and attitudes toward telemedicine.
5. To investigate the perceived barriers to the effective use of telemedicine among teachers in Mararaba, Nasarawa State, with a specific focus on internet reliability, data privacy concerns, and lack of user guidance.

Research Questions

1. What is the current level of awareness among teachers about telemedicine?
2. What are teachers' attitudes toward using telemedicine for managing their health?
3. What are the main sources of information about telemedicine among teachers?
4. What are the major barriers preventing teachers from effectively using telemedicine?

Research Hypotheses

1. There will be no significant relationship between teachers' demographic characteristics and their awareness of telemedicine.
2. There will be no significant relationship between teachers' demographic characteristics and their attitudes toward telemedicine.

Methodology

Research Design

This study adopted the descriptive survey design to explore teachers' awareness of the use of telemedicine for wellness. This design is appropriate for gathering data from a population in its natural setting and for describing the current level of awareness and related factors without manipulating any variables.

Population of the Study

The population for this study comprises all primary and secondary school teachers in Mararaba, Nasarawa State. This includes both public and private school teachers who are actively engaged in teaching during the period of data collection.

Sample and Sampling Technique

A sample of 150 teachers was selected using a stratified random sampling technique to ensure representation across different school types (public and private), educational levels (primary and secondary), and demographic characteristics (e.g., gender, age).

Instrument for Data Collection

The primary instrument for data collection was a structured questionnaire titled Teachers' Awareness of Telemedicine for Wellness Questionnaire (TATWQ). The questionnaire was

divided into sections that covered demographic information, awareness of telemedicine, sources of information about telemedicine, and perceived benefits and limitations. It consisted of closed-ended items designed to capture quantitative data.

Validity and Reliability of the Instrument

To ensure content validity, the draft questionnaire was reviewed by experts in health education and educational research. A pilot test was conducted with 20 teachers in FCT (not included in the main study), and Cronbach's Alpha was used to test reliability, with a threshold of 0.70 considered acceptable.

Method of Data Collection

Questionnaires were administered in person with the assistance of trained research assistants. Respondents were given adequate time to complete the questionnaire and were assured of the confidentiality of their responses.

Method of Data Analysis

Collected data were analyzed using descriptive statistics such as frequency counts, percentages, mean scores, and standard deviations. Where appropriate, inferential statistics such as Chi-square tests were used to examine relationships between awareness and demographic variables.

Results

Table 1: Demographic Characteristics of the Teachers

Characteristics	Categories	Frequency
Age	20-29 Years	36 (24%)
	30-39 Years	37 (24.7%)
	40-49 Years	45 (30%)
	50 Years Above	32 (21.3%)
Gender	Males	77 (51.3%)
	Females	73 (48.7%)
Years of Teaching Experience		42 (28%)
	1-5 years	55 (36.7%)
	6-10 years	30 (20%)
	11-15 years	23 (15.3%)
	16 years and above	
Educational Qualification	NCE	42 (28%)
	B.Ed/B.Sc	62 (41.3%)
	M.Ed/M.Sc.	40 (26.7%)
	Ph.D.	6 (4%)

Source: Field Survey

Based on Table 1, the age distribution of the teachers shows a fairly balanced spread across the four age categories. A total of 36 teachers (24%) were between 20 and 29 years, while 37 teachers (24.7%) fell within the 30 to 39 years category. The largest proportion comprised 45 teachers (30%) aged 40 to 49 years, followed closely by 32 teachers (21.3%) aged 50 years and above. This indicates that a significant portion of the teaching workforce in Mararaba, Nasarawa State, is middle-aged, reflecting both youthful entrants into the profession and more experienced teachers nearing retirement.

In terms of gender, the distribution shows a relatively even representation. Males constituted 77 teachers (51.3%), while females accounted for 73 teachers (48.7%). This near parity suggests that teaching in the area is an inclusive profession with no pronounced gender

dominance, which may positively influence collaborative approaches to professional development initiatives, including the adoption of telemedicine for wellness.

The teaching experience of respondents also varied considerably. Teachers with 1 to 5 years of experience numbered 42 (28%), while those with 6 to 10 years of experience were the most represented group, totaling 55 (36.7%). A further 30 teachers (20%) had 11 to 15 years of experience, and 23 teachers (15.3%) reported having 16 years or more of classroom practice. This distribution indicates that a significant number of teachers are in their early or mid-career stages, potentially affecting their openness to technological innovations such as telemedicine. Regarding educational qualifications, the table shows that 42 teachers (28%) held Nigeria Certificate in Education (NCE), 62 teachers (41.3%) possessed Bachelor of Education (B.Ed.) or Bachelor of Science (B.Sc.) degrees, while 40 teachers (26.7%) had Master of Education (M.Ed.) or Master of Science (M.Sc.) degrees. Only 6 teachers (4%) held doctoral (Ph.D.) qualifications. This suggests that the teaching population is generally well-qualified, with a substantial portion having advanced degrees, which may influence their capacity to understand and adopt emerging health technologies.

Therefore, the demographic data reflect a teaching workforce that is diverse in age, experience, and educational attainment, with balanced gender representation. These characteristics provide an important context for examining teachers' awareness and attitudes toward the use of telemedicine for wellness, as such demographic variables often shape perceptions, access to information, and willingness to adopt new practices.

Research Question 1: What is the current level of awareness among teachers about telemedicine?

Table 2: Descriptive Statistics of the Level of Awareness about Telemedicine among Teachers

Item	Frequency	Percentage (%)	Mean	SD
Heard of telemedicine	Yes-93	62.00	1.30	0.46
	No-57	38.00		
Self-rated knowledge of telemedicine	Very Poor- 28	18.70	2.60	0.92
	Poor-46	30.70		
	Good-54	36.00		
	Very Good-22	14.36		
Correct identification of telemedicine functions	Yes-97	64.7	1.35	0.48
	No-53	35.3		
Belief that telemedicine can promote wellness	Strongly Disagree-6	4.00	3.70	0.97
	Disagree-14	9.30		
	Neutral-32	21.30		
	Agree-64	42.70		
	Strongly Agree-34	22.70		

Table 2 presents the descriptive statistics on teachers' awareness of telemedicine. Findings show that a majority of respondents (62%) had heard of telemedicine, while 30% had not. In terms of self-rated knowledge, most teachers described their knowledge as either good (36%) or poor (30.7%), with fewer indicating very good (14.6%) or very poor (18.7%) knowledge. Similarly, 64.7% were able to correctly identify telemedicine functions, suggesting a moderate level of understanding. Regarding perceptions of its usefulness, most teachers believed telemedicine could promote wellness, with 42.7% agreeing and 22.7% strongly agreeing, while

only 13.3% disagreed. Overall, the results suggest that although teachers' awareness of telemedicine is relatively high, their knowledge of the subject remains limited in depth.

Research Question 2: What are teachers' attitudes toward using telemedicine for managing their health?

Table 3: Descriptive Statistics of Teachers' Attitudes toward Using Telemedicine for Managing Their Health

Attitude Statement	Response Category	Frequency	(%)	Mean	SD
Telemedicine is useful for managing personal health	Disagree	15	10.00	3.92	0.98
	Neutral	28	18.70		
	Agree	72	48.00		
	Strongly Agree	35	23.30		
I am willing to use telemedicine if available	Strongly Disagree	9	6.00	3.85	1.01
	Disagree	18	12.00		
	Neutral	30	20.00		
	Agree	63	42.00		
I prefer telemedicine over in-person hospital visits for non-emergency cases	Strongly Disagree	20	13.30	3.21	1.19
	Disagree	34	22.7		
	Neutral	40	26.7		
	Agree	38	25.3		
I trust the accuracy of diagnoses given through telemedicine platforms	Strongly Disagree	14	9.3	3.36	1.11
	Disagree	28	18.7		
	Neutral	42	28		
	Agree	44	29.3		
I think telemedicine will improve access to healthcare in my community	Strongly Disagree	6	4	3.97	0.95
	Disagree	14	9.3		
	Neutral	29	19.3		
	Agree	68	45.3		
	Strongly Agree	33	22		

Table 3 shows the descriptive statistics of teachers' attitudes toward using telemedicine for managing their health. The results indicate that a majority of teachers viewed telemedicine positively. Nearly half (48%) agreed and 23.3% strongly agreed that telemedicine is useful for managing personal health ($M = 3.92$, $SD = 0.98$). Similarly, 42% agreed and 20% strongly agreed that they were willing to use telemedicine if available, with only a small proportion (18%) expressing unwillingness ($M = 3.85$, $SD = 1.01$).

However, preferences were more divided regarding substituting telemedicine for in-person hospital visits in non-emergency cases: while 25.3% agreed and 12% strongly agreed, a sizable 36% disagreed or strongly disagreed, and 26.7% remained neutral ($M = 3.21$, $SD = 1.19$). Trust in telemedicine diagnoses was also mixed, with 44% agreeing or strongly agreeing, 28% neutral, and 28% disagreeing ($M = 3.36$, $SD = 1.11$).

Finally, attitudes were most favourable regarding telemedicine's impact on access to healthcare, with 45.3% agreeing and 22% strongly agreeing, compared to just 13.3%

disagreeing ($M = 3.97$, $SD = 0.95$). Therefore, these findings suggest that while teachers generally have a positive attitude toward telemedicine and its potential benefits, some reservations remain regarding substituting in-person visits and trusting remote diagnoses.

Research Question 3: What are the main sources of information about telemedicine among teachers?

Table 4: Statistics of the Sources of Information about Telemedicine among Teachers

Source of Information	Frequency (n)	Percentage (%)
Social media	60	40.00
Internet	15	10.00
Health professionals	28	18.70
Friends/colleagues	18	12.00
Television/Radio/News	18	12.00
Never received information	57	38.00

Table 4 presents the sources of information about telemedicine among teachers. The results reveal that social media was the most common source, reported by 40% of the respondents. Friends and colleagues were also important, accounting for 29.3%, while 18.7% indicated that they obtained information through health professionals. Traditional media sources such as television, radio, and newspapers contributed the least, with only 12% of teachers relying on them. In addition, 38% of the teachers reported never receiving any information about telemedicine at all. These findings suggest that informal and digital platforms serve as the main channels of awareness, while formal and institutional sources remain underutilized, leaving a considerable proportion of teachers uninformed about telemedicine.

Research Question 4: What are the major barriers preventing teachers from effectively using telemedicine?

Table 5: Descriptive Statistics of the Major Barriers Preventing Teachers from Effectively Using Telemedicine

Barrier	Frequency (n)	Percentage (%)
Poor internet connectivity	86	57.3
Lack of awareness/knowledge about telemedicine	72	48
High cost of internet/data subscription	65	43.3
Limited access to required devices (smartphones/computers)	54	36
Concerns about accuracy and trust of diagnosis	47	31.3
Lack of technical support/training	42	28
Privacy and confidentiality concerns	38	25.3
Lack of government policy or institutional support	29	19.3

Table 5 presents the major barriers preventing teachers from effectively using telemedicine. The findings show that technological challenges were the most frequently reported obstacles. More than half of the teachers (57.3%) identified poor internet connectivity as the main barrier, followed closely by lack of awareness or knowledge about telemedicine (48%) and the high cost of internet/data subscriptions (43.3%). Other notable barriers included limited access to required devices such as smartphones and computers (36%) and concerns about the accuracy

and trustworthiness of telemedicine diagnoses (31.3%). Additionally, 28% reported lack of technical support or training as a hindrance, while 25.3% expressed privacy and confidentiality concerns. Institutional factors were also mentioned, with 19.3% pointing to inadequate government policies or institutional support as limiting telemedicine use. In summary, these results suggest that while teachers recognize the potential of telemedicine, infrastructural, financial, and informational barriers remain significant obstacles to its effective utilization.

Ho1: There will be no significant relationship between teachers' demographic characteristics and their awareness of telemedicine.

Table 6: Chi-Square Test of Independence on Teachers' Demographic Characteristics and Awareness of Telemedicine

Demographic Variable	χ^2	df	p-value
Age	4.82	3	0.816
Gender	0.97	1	0.325
Years of Teaching Experience	6.13	3	0.105
Educational Qualification	7.42	3	0.059

The results in Table 6 indicated that there were no statistically significant associations between age and awareness of telemedicine, $\chi^2(3, N = 150) = 4.82, p = 0.186$; gender and awareness, $\chi^2(1, N = 150) = 0.97, p = 0.325$; years of teaching experience and awareness, $\chi^2(3, N = 150) = 6.13, p = 0.105$; and educational qualification and awareness, $\chi^2(3, N = 150) = 7.42, p = 0.059$. These findings suggest that awareness of telemedicine among teachers does not significantly differ across demographic groups. Thus, the null hypothesis (Ho₁) was retained.

Ho2: There will be no significant relationship between teachers' demographic characteristics and their attitudes toward telemedicine.

Table 7: Chi-square Test of Independence Result for Teachers' Demographic Characteristics and Attitudes toward Telemedicine

Demographic Characteristic	χ^2	df	p-value
Age	5.63	9	0.777
Gender	2.04	3	0.565
Years of Teaching Experience	7.92	9	0.541
Educational Qualification	8.71	9	0.464

Table 7 showed no statistically significant relationships between age and attitudes toward telemedicine, $\chi^2(9, N = 150) = 5.63, p = .777$; gender and attitudes, $\chi^2(3, N = 150) = 2.04, p = .565$; years of teaching experience and attitudes, $\chi^2(9, N = 150) = 7.92, p = .541$; and educational qualification and attitudes, $\chi^2(9, N = 150) = 8.71, p = .464$. This indicates that teachers' attitudes toward telemedicine were not significantly influenced by their demographic characteristics. Therefore, the null hypothesis (Ho₂) was retained.

Discussion of Findings

The findings from Table 2 align with previous studies showing that awareness of telemedicine among educators and health-related stakeholders is often moderate to high, but depth of knowledge remains limited. For example, Alshammari et al. (2022) found that although a majority of teachers in Saudi Arabia had heard of telemedicine, less than one-fifth rated their knowledge as good, reflecting the same pattern observed in this study, where only 14.6% reported very good knowledge. Similarly, Adepoju et al. (2021) reported that while

telemedicine awareness in Nigeria has grown due to increased digital health promotion, misconceptions about its scope and functions remain common, as also seen in the 35.3% of teachers in this study who could not correctly identify telemedicine functions.

In terms of attitudes, the positive perception of telemedicine's role in promoting wellness observed here (65.4% agreeing or strongly agreeing) is consistent with the work of Gajarawala and Pelkowski (2021), who noted that teachers and healthcare workers often believe telemedicine improves access and supports preventive care despite knowledge gaps. Likewise, Okereke et al. (2020) emphasized that Nigerian teachers tend to have favorable attitudes toward health innovations, but require structured training to fully understand their application. Taken together, the findings of this study are justified by existing literature, which similarly demonstrates that while awareness of telemedicine is relatively widespread, knowledge depth and practical understanding are insufficient.

The results from Table 3 demonstrate that teachers generally hold positive attitudes toward telemedicine, though with some reservations regarding its substitution for in-person care and the accuracy of remote diagnoses. These findings are consistent with existing studies. For instance, Gajarawala and Pelkowski (2021) observed that while users perceive telemedicine as a useful tool for managing personal health and improving access, hesitancy remains around fully replacing traditional consultations. This supports the finding that although 71.3% of teachers in this study considered telemedicine useful, only 37.3% preferred it over hospital visits for non-emergency cases.

Similarly, Eze et al. (2020), in their study of telemedicine adoption in Nigeria, reported that willingness to use telemedicine was relatively high due to increasing digital literacy, aligning with the 62% of teachers here who expressed willingness to adopt it if available. However, their study also noted skepticism around diagnosis accuracy, echoing the mixed levels of trust observed in this study, where 44% agreed or strongly agreed, but 28% remained neutral and another 28% disagreed.

In terms of perceived benefits for community healthcare access, the majority of teachers in this study believed telemedicine could improve accessibility. This is reinforced by Almathami et al. (2020), who highlighted telemedicine's potential to reduce barriers such as distance, cost, and shortage of healthcare professionals, especially in underserved communities. Likewise, Adepoju et al. (2021) confirmed that in Sub-Saharan Africa, telemedicine is increasingly recognized as a tool to bridge healthcare gaps, despite infrastructural challenges. Generally, the findings of this study are consistent with literature showing that attitudes toward telemedicine are generally positive, but issues of trust and preference for physical consultations remain key barriers to full acceptance.

The findings from Table 4 are consistent with previous studies showing that informal and digital platforms are the dominant sources of health-related information in many low- and middle-income countries. For example, Adebayo et al. (2021) noted that social media is increasingly the primary channel through which Nigerian teachers and students access health innovations, reflecting the 48% reliance observed in this study. Similarly, Osuagwu et al. (2021) reported that during the COVID-19 pandemic, social media and peer networks were more influential in disseminating telemedicine information than formal government outlets, aligning with the 29.3% reliance on colleagues and the absence of government websites as a reported source in this study. In addition, Almathami, Win, and Vlahu-Gjorgievska (2020) highlighted that although health professionals are considered credible sources, their role in promoting telemedicine remains limited in many settings, which supports the relatively low percentage (18.7%) recorded here. The significant proportion of teachers (38%) who had never received any information about telemedicine is in line with Adepoju et al. (2021), who emphasized that gaps in official communication and limited digital health strategies continue to leave many Nigerians uninformed. Taken together, these findings echo the literature that

while social and digital networks play a leading role in creating awareness, reliance on formal and institutional channels of health communication, particularly government websites, remains weak.

The barriers reported in Table 5 are strongly supported by existing literature on telemedicine adoption, particularly in low- and middle-income countries. Poor internet connectivity emerged as the leading barrier (57.3%), which is consistent with Oyediran et al. (2020), who noted that infrastructural limitations, especially unstable internet networks, remain one of the biggest obstacles to telemedicine in Nigeria. Similarly, Adebayo et al. (2021) emphasized that inadequate bandwidth and unreliable service delivery discourage consistent use of digital health services.

The finding that 48% of teachers lacked adequate knowledge or awareness of telemedicine aligns with Ogunleye, Ajala, and Ajayi, (2023) who reported that low digital literacy and limited sensitization significantly undermine adoption rates among professionals in Nigeria. In addition, the high cost of data (43.3%) resonates with the observations of Adepoju et al. (2021), who identified financial constraints and high data subscription costs as barriers to sustainable telehealth use in Sub-Saharan Africa. The concerns about diagnosis accuracy and privacy also reflect global trends. Gajarawala and Pelkowski (2021) pointed out that skepticism about the accuracy of remote diagnoses, coupled with data security concerns, continues to hinder trust in telemedicine platforms. Finally, the relatively lower but notable proportion citing lack of government policy or institutional support is consistent with Osuagwu et al. (2021), who highlighted weak regulatory frameworks and insufficient institutional backing as systemic challenges to telemedicine expansion in Africa. Therefore, the literature justifies the findings that barriers to effective telemedicine use are multidimensional, spanning infrastructural, financial, knowledge-based, and institutional domains.

The results of the chi-square analyses for both research hypotheses revealed that teachers' demographic characteristics, such as age, gender, years of teaching experience, and educational qualification, did not significantly influence either their awareness or attitudes toward telemedicine. For H_{01} , the lack of significant associations indicates that awareness of telemedicine among teachers was relatively consistent across demographic groups, suggesting that exposure to information about telemedicine is not limited to a specific age bracket, gender, or educational attainment. Similarly, the findings from H_{02} showed that teachers' attitudes toward telemedicine were also not determined by demographic differences, reflecting a uniform perception of telemedicine's potential benefits regardless of personal characteristics. These findings align with previous literature emphasizing that awareness and attitudes toward telemedicine are shaped more by contextual and structural factors than by demographic profiles. For instance, Gajarawala and Pelkowski (2021) observed that the perceived usefulness and trust in telemedicine systems were stronger predictors of adoption than socio-demographic attributes. Likewise, Adu et al. (2022) highlighted that awareness and willingness to use telemedicine in Nigeria were primarily influenced by accessibility, training, and system reliability rather than by teachers' age or gender. Moreover, Alshammari et al. (2021) found that once digital health systems are introduced and users are trained, attitudinal differences across demographic lines become minimal.

Taken together, the findings from both H_{01} and H_{02} suggest that in the context of teachers, the challenge of telemedicine adoption is less about who they are (demographics) and more about what they have access to (resources, infrastructure, and reliable systems). This implies that interventions to improve telemedicine uptake should prioritize awareness campaigns, provision of affordable access, and digital literacy programmes rather than focusing on demographic targeting.

Conclusion

This study, titled “Exploration of Teachers’ Awareness and Attitude Towards the Use of Telemedicine for Wellness in Mararaba, Nasarawa State,” examined the extent to which teachers are aware of, and willing to adopt, telemedicine as part of their health management practices. Findings revealed that while a significant proportion of teachers in Mararaba have heard about telemedicine and demonstrated positive attitudes towards its usefulness for wellness, their knowledge about its specific functions remains limited. Social media was identified as the main source of information, whereas official government platforms were rarely used. Despite the willingness of teachers to adopt telemedicine, barriers such as poor internet connectivity, high cost of data, inadequate awareness campaigns, and limited institutional support hinder its effective utilization.

The hypothesis testing further established that demographic characteristics such as age, gender, years of teaching experience, and educational qualification did not significantly influence teachers’ awareness or attitudes toward telemedicine. This suggests that the challenges of adoption are largely systemic rather than individual. Therefore, the study concludes that teachers in Mararaba are positively disposed toward telemedicine, but infrastructural and policy gaps must be addressed to facilitate effective uptake.

Recommendations

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

1. Government and health stakeholders should intensify sensitisation efforts through both conventional and digital media to increase teachers’ understanding of telemedicine and its benefits for wellness.
2. Reliable internet connectivity and affordable data access should be prioritized in Nasarawa State to reduce digital exclusion and support seamless telemedicine usage.
3. Regular training programmes on digital literacy and telemedicine use should be integrated into teachers’ professional development to strengthen their confidence and skills.
4. Policymakers should develop clear guidelines that guarantee privacy, confidentiality, and service quality in telemedicine, ensuring trust among teachers and the wider community.
5. Partnerships with telecommunication companies and health institutions can reduce costs, provide affordable devices, and expand access to telemedicine services for teachers.
6. Since teachers rely heavily on social media for information, government agencies should actively disseminate accurate and reliable telemedicine-related information through these channels.

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INSTITUTIONAL GOVERNANCE PRACTICES AS CORELLATE OF GOAL ACHIEVEMENT OF SECONDARY EDUCATION IN PUBLIC SENIOR SCHOOLS IN ABUJA, NIGERIA

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Abstract

Education is universally recognized as a key driver of national development, and effective institutional governance serves as a vital mechanism for ensuring that educational objectives are achieved. In Nigeria, particularly within public secondary schools, governance practices play a crucial role in determining the extent to which educational goals such as academic excellence, moral development, and skill acquisition are realized. This study, therefore, empirically investigated the relationship between institutional governance practices and goal achievement of secondary education in public senior secondary schools in Abuja, Nigeria. The study adopted a correlational research design. The population consisted of 4,152 teachers across 88 public senior secondary schools in the Federal Capital Territory, from which a sample of 354 teachers was selected using a multistage sampling procedure guided by Krejcie and Morgan's sampling table. A researcher-designed instrument titled Institutional Governance Practices and Goal Achievement of Secondary Education Questionnaire (IGPGASEQ), validated by experts and yielding a reliability coefficient of 0.82 using Cronbach's Alpha, was used for data collection. Descriptive statistics of mean and standard deviation were employed to answer the research questions, while Pearson Product Moment Correlation Coefficient (PPMCC) was used to test the hypotheses at 0.05 level of significance. Findings revealed that delegation of authority ($M = 3.71$, $SD = 0.87$) and the use of committee systems ($M = 3.45$, $SD = 0.63$) are the most practiced governance strategies, while participatory decision-making ($M = 2.76$, $SD = 0.32$) is least applied. Results further showed that the overall level of goal achievement of secondary education in Abuja is moderate (grand mean = 3.14), with communication skills ranking highest and manipulative or vocational skills ranking lowest. Inferential analyses indicated a strong and significant positive relationship between institutional governance practices and goal achievement ($r = 0.86$, $p < 0.05$). Specifically, delegation of authority ($r = 0.88$, $p < 0.05$) and committee systems ($r = 0.76$, $p < 0.05$) showed strong associations, while participatory decision-making ($r = 0.51$, $p < 0.05$) showed a moderate but significant relationship. The study concludes that effective institutional governance practices significantly enhance the realization of secondary education goals. It recommends that school administrators strengthen participatory governance, institutionalize committee systems, and provide continuous leadership training to improve accountability, teamwork, and vocational skill development among students in line with Nigeria's National Policy on Education.

Keywords: *Institutional Governance, Delegation of Authority, Participatory Decision-making, Committee System, Goal Achievement*

Introduction

Education remains a fundamental instrument for social, political, and economic development in Nigeria. Secondary education among other level of education serves as a bridge between basic and tertiary education with intention of equipping learners with knowledge,

skills, and values necessary for meaningful participation in society. Despite the strategic importance of secondary education, many public senior secondary schools in Abuja face challenges related to governance, management, and accountability. Institutional governance, as a key administrative function, encompasses the systems, structures, and processes through

which schools are directed, controlled, and held accountable. Governance in educational institutions involves transparency, accountability, participation, and effective leadership towards achieving the stated goals of education. When governance structures are weak or inefficient, the realization of educational goals such as academic excellence, character formation, and skill development is undermined. Institutional governance refers to the system of rules, structures, and processes through which educational institutions are directed, controlled, and held accountable for achieving the stated goals and objectives. It encompasses how decisions are made, implemented, and evaluated to ensure transparency, accountability, and effectiveness in achieving institutional goals (OECD, 2012; World Bank, 2017). In the context of education, governance determines how power and authority are distributed among stakeholders such as administrators, teachers, students, governing boards, and regulatory agencies (Akpan & Udo, 2021).

According to Egwu and Ekwe (2021), institutional governance provides the framework through which leadership practices, decision-making, and accountability mechanisms are coordinated to enhance educational outcomes. Effective governance structures promote participatory decision-making, transparency in financial management, and equitable allocation of resources. When properly implemented, these practices strengthen institutional effectiveness and contribute to the realization of educational goals (Odok, Uche, & Effiom, 2023). In Nigeria, institutional governance in secondary education involves a combination of governmental oversight, school-based management, and community participation. The Ministry of Education and quality assurance departments play central roles in monitoring compliance with national policies and standards (Oladipo & Adediran, 2020). However, research indicates that many public secondary schools still experience challenges such as weak administrative structures, inadequate stakeholder involvement, and poor financial accountability, all of which undermine educational quality and goal achievement (Adebayo & Fadeyi, 2020; Bello & Yusuf, 2019). Empirical studies have consistently shown that good governance practices are characterized by leadership competence, participatory management, and sound financial administration that are positively correlated with students' academic performance and institutional effectiveness (Lawore & Adefabi, 2022; Egwu & Ekwe, 2021). Conversely, institutions with poor governance frameworks often exhibit inefficiency, low staff morale, and diminished student outcomes (World Bank, 2017). Therefore, institutional governance remains a vital determinant of the quality, equity, and sustainability of educational systems.

Meanwhile, goal achievement is the extent to which the predetermined objectives of an individual, organization, or system is realized through coordinated efforts and effective utilization of resources. In the context of education, goal achievement denotes the successful attainment of the aims and objectives established within the educational system, such as improved academic performance, moral development, skill acquisition, and societal advancement (Akinyemi & Adetunji, 2021). It serves as a benchmark for assessing the effectiveness and efficiency of educational institutions in fulfilling the mandates. According to Locke and Latham (2002), goal achievement is a function of clearly defined goals, motivation, and feedback mechanisms that guide behavior toward desired outcomes. When applied to schools, this means that administrators, teachers, and students must work collectively within an organized governance framework to achieve educational objectives. The process of achieving goals involves planning, implementation, monitoring, and evaluation of strategies aimed at realizing institutional missions (Adebayo & Fadeyi, 2020).

In secondary education, goal achievement reflects how well schools attain national educational goals as stated in the National Policy on Education (2014) such as academic excellence, character development, and manpower training. The extent of goal achievement can be measured through indicators such as students' academic performance, effective school management, discipline, teacher productivity, and quality assurance outcomes (Okoye, 2021).

Secondary education in Nigeria serves as a crucial link between basic education and tertiary education, providing students with the knowledge, skills, and attitudes necessary for personal development and national progress. According to the Federal Republic of Nigeria (FRN, 2014) secondary education is designed to prepare individuals for useful living within society and for higher education pursuits. It aims to produce citizens who are intellectually sound, morally upright, and socially responsible. The policy outlines six major goals of secondary education in Nigeria as follows:

- a. To provide an increasing number of primary school pupils with the opportunity for education of a higher level, irrespective of sex, social, or religious background. This is to ensure inclusiveness and equity, enabling broad access to educational opportunities beyond the primary level.
- b. To offer diversified curriculum catering to the differences in talents, opportunities, and future roles of learners. This is achieved through general and vocational subjects that develop both academic and practical skills.
- c. To provide trained manpower in the applied sciences, technology, and commerce at sub-professional grades.
Secondary education contributes to the economic development of Nigeria by equipping students with employable and entrepreneurial skills.
- d. To inspire students with a desire for self-improvement and achievement of excellence. This encourages lifelong learning and the development of a culture of hard work and innovation among youths.
- e. To foster national unity with an emphasis on the common ties that unite Nigerians in spite of ethnic, cultural, and religious diversity.
Through civic education, social studies, and national integration programs, secondary schools promote patriotism and tolerance.
- f. To raise morally upright and well-adjusted individuals who can think independently and contribute meaningfully to society.
This goal highlights the moral, ethical, and civic dimensions of education as essential to nation-building.

As Emeh and Ezeani (2020) noted, these goals align with Nigeria's national educational philosophy, which seeks to build a free, democratic, just, and egalitarian society. Similarly, Okoye (2021) observed that effective implementation of these objectives requires good governance, adequate resources, and strong quality assurance mechanisms within the secondary school system.

Theoretical framework explaining the bond between institutional governance and goal achievement is Goal-Setting Theory (Locke & Latham, 1990, 2002). The theory provides a strong foundation for explaining how institutional governance influences goal achievement in educational settings. The theory, developed by Edwin A. Locke and Gary P. Latham, posits that specific and challenging goals, coupled with appropriate feedback, lead to higher levels of performance than vague or easy goals (Locke & Latham, 2002). Thus, in the context of educational institutions, institutional governance provides the structure within which goals are defined, communicated, and monitored. Governance determines leadership effectiveness, transparency, accountability, and stakeholder participation—all of which shape how institutional goals are pursued and achieved.

According to the theory, four major mechanisms explain the link between governance and goal achievement:

1. Direction: Governance provides clear institutional direction through well-defined policies and objectives.

2. Effort: Effective leadership motivates teachers and staff to put forth greater effort toward school improvement.
3. Persistence: Strong governance structures ensure consistency in pursuing school goals despite challenges.
4. Strategy Development: Governance encourages innovation and strategic planning that led to educational effectiveness.

Empirical evidence supports this relationship. For instance, Egwu and Ekwe (2021) found that principals' administrative competence as a governance variable is significantly correlated with students' academic performance, reflecting successful goal attainment. Similarly, Odok, Uche, and Effiom (2023) showed that good financial management practices enhance institutional effectiveness, which aligns with Goal-Setting Theory's emphasis on structured pursuit of objectives.

However, achieving the goals of secondary education in Nigeria has been hindered by weak institutional governance practices across many public schools. Despite various educational reforms and increased government funding, several studies have revealed that governance challenges such as poor accountability, limited stakeholder participation, and inadequate supervision persist in the Nigerian secondary education system (Adeyemi & Adan, 2019; Olaleye & Arogundade, 2021). These governance deficits have led to inefficiencies in school management, teacher demotivation, and low student performance in both internal and external examinations. Empirical evidence from the Federal Ministry of Education (2022) reveals that public senior secondary schools in Abuja recorded an average of 42.6% pass rate in the West African Senior School Certificate Examination (WASSCE) between 2019 and 2022, a figure far below the national target of 70%. Researchers have linked such low achievement to the ineffective enforcement of governance standards and weak school leadership practices (Ezekiel & Ajayi, 2020).

In a study conducted in Kwara and Lagos States, Oyetunji (2017) found that participatory governance, transparency in decision-making, and accountability significantly correlated with improved institutional effectiveness and student outcomes. Similarly, Aina (2021) reported that schools with clearly defined governance structures performed better in instructional delivery and student discipline than those with autocratic or poorly coordinated administrative systems. However, comparable studies focusing on the Federal Capital Territory, Abuja, remain limited, creating a gap in the contextual understanding of how governance practices affect secondary education goal achievement in this region.

Purpose of the Study

The main purpose of this study was to examine the relationship between institutional governance practice and goal achievement of secondary education in public secondary schools in Abuja, Nigeria. Other specific purposes are:

- i. to identify the institutional governance practices commonly used for goal achievement secondary education in public secondary schools in Abuja, Nigeria;
- ii. determine the level of goal achievement of secondary education secondary education in public secondary schools in Abuja, Nigeria;
- iii. to determine the use delegation of authority for goal achievement of secondary education in public secondary schools in Abuja, Nigeria;
- iv. to examine the use participatory decision making for goal achievement of secondary education in public secondary schools in Abuja; and
- v. to determine use of committee system for goal achievement of secondary education in public secondary schools in Abuja, Nigeria.

Research Questions

The following research questions were raised to guide the study.

1. What are the mostly used institutional governance practice in public secondary schools in Abuja, Nigeria?
2. What is the level of goal achievement of secondary education in public secondary schools in Abuja, Nigeria?

Hypotheses

The following hypotheses were generated to guide the study and tested at 0.05 level of significance.

- H₀₁:** There is no significance relationship between institutional governance practices and goal achievement of secondary education in public secondary schools in Abuja, Nigeria;
- H₀₂:** There is no significance relationship between delegation of authority and goal achievement of secondary education in public secondary schools in Abuja, Nigeria;
- H₀₃:** There is no significance relationship between participatory decision-making and goal achievement of secondary education in public secondary schools in Abuja, Nigeria; and
- H₀₄:** There is no significance relationship between the use of committee system and goal achievement of secondary education in public secondary schools in Abuja, Nigeria.

Methodology

The study covered all public senior secondary schools in Abuja, the Federal Capital Territory of Nigeria. There are 88 public senior secondary schools and 4,152 teachers in the six Area Councils in Abuja, Nigeria.

Table 1
Senior Schools in Abuja Area Council, Nigeria

Area Councils	Number of Schools	Available Teachers	Number of
Abaji	10	501	
Bwari	13	482	
Gwagwalada	13	688	
Kuje	13	545	
Kwali	9	431	
Municipal	30	1,505	
Total	88	4,152	

Source: FCT Secondary Education Board, 2024

The research design adopted for this study was the correlational research design. The correlational research design was used for this study in view of the fact that the researcher does not have any intention to manipulate the study's variable but to study them as they occur naturally and determine their degree or level of relationship. The sampling technique used to select the respondents needed for the study is multistage sampling method. And, in order to determine the sample size needed for the study, the Krejcie and Morgan (1970) sampling size table was used to draw the sample size of 354 to be used for the study. The sample of 354 respondents was chosen using purposive sampling technique on public senior secondary school teachers. Stratified sampling technique was used to group teachers according to the six area councils in Abuja. Simple random technique was adopted to select teachers across the three zones. Hence, 354 out of 4,152 represents 9% of the whole population. This is considered okay due to the uniformity in the characteristics of the respondents in area of condition of their

employment, promotion, curriculum implementation and other conditions of service. Meanwhile, a researcher-designed questionnaire was developed and tagged "Institutional Governance Practices and Goal Achievement of Secondary Education Questionnaire (IGPGASEQ)". The Questionnaire was divided into sections A, B and C. Section A, focused on background information of the respondents such as; their qualification, sex and others. While section B contained the statements to rate the application and utilization of institutional governance practices in secondary schools. The section C encompasses statements to determine the bond between institutional governance practices and goal achievement of secondary education in the study area. A 4-point Likert scale- Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) was used for rating. The instrument was subject to content and construct validity and overall Cronbach Alpha value of 0.82 reliability coefficient score was obtained. This implies that the instrument is having high degree reliability. Meanwhile, both descriptive (mean score) and inferential statistics (Pearson product moment correlation coefficient) were used to analyze the data. All the hypotheses were tested at 0.05 level of significance.

Data Presentation, Analysis and Discussion of Findings

The research questions were analysed using mean scores descriptive statistics.

Research Question One: What are the mostly used institutional governance practices in public secondary schools in Abuja, Nigeria?

Table 2

Mean Score and Standard Deviation Analysis of the Mostly Used Institutional Governance Practices in Public Secondary Schools in Abuja, Nigeria

S/ No	Institutional Practice	Governance	Mean	SD	Decision	Ranking
1	Delegation of Authority		3.71	0.87	Accepted	1 st
2	Participation Decision Making		2.76	0.32	Accepted	3 rd
3	Use of Committee System		3.45	0.63	Accepted	2 nd

Source: Field Work, 2025

Table 2 presents the mean scores on the mostly used institutional governance practices in public senior secondary schools in Abuja, Nigeria. The items have mean scores of 3.71, 2.76 and 3.45 accordingly. These scores are ranked to show how the practices are used. Delegation of authority is ranked first and it means that it is the most used institutional governance practice in the study area. And, this is followed by the use of committee system and participatory decision-making is least used among the practices.

Research Question Two: What is the level of goal achievement of secondary education in public secondary schools in Abuja, Nigeria?

Table 3

Mean Score Analysis of the Goal Achievement of Secondary Education in Public Secondary Schools in Abuja

Level of Achievement	Goal	Mean Score	Standard Deviation	Rank
Manipulative (Soft Acquisition)	Skill Skills	2.53	0.52	3 rd

Human Relation Skill	3.04	0.77	2 nd
Communication Skill	3.87	0.88	1 st
Grand Mean	3.14		

Source: Field report, 2025

The descriptive analysis of the mean scores in Table 3 shows the level of goal achievement of secondary education in the study area. Among the three factors that are used to measure goal achievement of secondary education. As revealed in the Table manipulative skills for soft skills acquisition is least ranked achieved goal and communication skill is the highest ranked goal. This implies that communication and human relation skills were given more attention among other goals in the study area.

Hypothesis of the Testing

The hypotheses formulated to guide the study were statistically analysed using Pearson Product Moment Correlation Coefficient (PPMCC) at 0.05 level of significant.

Ho₁: *There is no significance relationship between institutional governance practices and goal achievement of secondary education in public secondary schools in Abuja, Nigeria*

Table 4

Correlation Analysis of Institutional Governance Practices and Goal Achievement

Variables	Number	Mean Score	Standard Deviation	Degree of Freedom	Calculated r-value	p-value	Decision
Institutional Governance Practices	354	3.30	0.42	352	0.86	0.00	Rejected
Goal Achievement	354	3.14	0.287				

p<0.05

Source: Field report, 2025

Table 4 presents the test of analysis of the relationship between institutional governance practices and goal achievement of secondary education in public secondary school in Nigeria. The calculated r-value is 0.86 and p-value of 0.00 is less than 0.05 level of significance. This implies that the relationship between the two observed variables is positive and significant (r-value = 0.86; p-value < 0.05 sig.). hence, the null hypothesis is rejected.

H₀₂: *There is no significance relationship between delegation of authority and goal achievement of secondary education in public secondary schools in Abuja, Nigeria*

Table 5

Correlation Analysis of Delegation of Authority and Goal Achievement

Variables	Number	Mean Score	Standard Deviation	Degree of Freedom	Calculated r-value	p-value	Decision
Delegation of Authority	354	3.71	0.87	352	0.88	0.00	Rejected
Goal Achievement	354	3.14	0.287				

p<0.05

Source: Field report, 2025

As revealed in Table 5, the test of analysis of the relationship between delegation of authority and goal achievement of secondary education in public secondary school in Abuja, Nigeria is presented. The calculated r-value is 0.88 and p-value of 0.00 is less than 0.05 level of significance. This implies that the relationship between the two observed variables is positive and significant (r-value = 0.88; p-value < 0.05 sig.). hence, the null hypothesis is rejected.

H₀₃: *There is no significance relationship between participatory decision-making and goal achievement of secondary education in public secondary schools in Abuja, Nigeria*

Table 6: Correlation Analysis of Participatory Decision-making and Goal Achievement

Variables	Number	Mean Score	Standard Deviation	Degree of Freedom	Calculated r-value	p-value	Decision
Participatory Decision-making	354	2.76	0.32	352	0.51	0.00	Rejected
Goal Achievement	354	3.14	0.287				

p<0.05

Source: Field report, 2025

As shown in Table 6, the test of analysis of the relationship between participatory decision-making and goal achievement of secondary education in public secondary school in Abuja, Nigeria is presented. The calculated r-value is 0.51 and p-value of 0.00 is less than 0.05 level of significance. This implies that the relationship between the two observed variables is positive but not significant (r-value = 0.51; p-value < 0.05 sig.). hence, the null hypothesis is rejected.

Ho₄: There is no significance relationship between the use of committee system and goal achievement of secondary education in public secondary schools in Abuja, Nigeria.

Table 7: Correlation Analysis of Use of Committee System and Goal Achievement

Variables	Number	Mean Score	Standard Deviation	Degree of Freedom	Calculated r-value	p-value	Decision
Use of Committee System	354	3.45	0.63	352	0.76	0.00	Rejected
Goal Achievement	354	3.14	0.287				

p<0.05

Source: Field report, 2025

As shown in Table 7, the test of analysis of the relationship between the use of committee system and goal achievement of secondary education in public secondary school in Abuja, Nigeria is presented. The calculated r-value is 0.76 and p-value of 0.00 is less than 0.05 level of significance. This implies that the relationship between the two observed variables is positive and significant (r-value = 0.76; p-value < 0.05 sig.). hence, the null hypothesis is rejected.

Discussion of Findings

Table 2 reveals that institutional governance practices such as delegation of authority, use of committee system, and participatory decision-making are the predominant practices in public senior secondary schools in Abuja. The ranking indicates that delegation of authority is the most commonly practiced governance approach, followed by the use of committee systems, while participatory decision-making is the least applied. This finding implies that administrators in public secondary schools in Abuja tend to rely more on hierarchical delegation and formal committee structures to manage institutional affairs, rather than promoting inclusive participation in decision-making. This aligns with the assertion of Adebayo and Akinsolu (2019) that Nigerian secondary schools are still characterized by bureaucratic governance styles where authority is often centralised, even though participatory governance improves institutional effectiveness. Similarly, Okeke (2020) emphasized that effective delegation enhances managerial efficiency and ensures timely implementation of educational policies. The relatively low utilization of participatory decision-making suggests that teachers and non-teaching staff may have limited involvement in administrative deliberations, which could affect ownership of school goals.

Table 3 shows that the mean score for communication skill ranks highest among indicators of goal achievement, followed by human relations skills, while manipulative or soft skills acquisition ranked lowest. The grand mean of 3.14 suggests that the general level of goal achievement of secondary education in Abuja is moderate. This finding indicates that while students appear to possess good communication and interpersonal skills, they demonstrate weaker manipulative or vocational competencies. This outcome supports the observations of Federal Republic of Nigeria (2014) in the National Policy on Education, which highlights the need for skill-oriented education to enhance employability. Similarly, Olatunji and Oduro (2021) found that Nigerian secondary schools often emphasize cognitive and affective domains more than the psychomotor domain, thereby hindering the achievement of balanced

educational goals. Thus, the finding underscores the need to reemphasize vocational and technical training components within the secondary school curriculum.

Table 4 showed a strong positive and significant relationship between institutional governance practices and goal achievement. Therefore, the null hypothesis is rejected. This result implies that effective governance practices significantly contribute to the attainment of educational goals. The finding corroborates Adeyemi (2018), who found that sound institutional governance promotes accountability, staff motivation, and improved student performance. Similarly, Obi and Okafor (2020) reported that when governance structures are transparent and participatory, schools tend to achieve higher educational outcomes. The result in Table 5 shows a calculated r -value of 0.88 with a p -value of 0.00, indicating a strong and significant positive relationship between delegation of authority and goal achievement. The null hypothesis is, therefore, rejected. This implies that when school heads effectively delegate responsibilities, it enhances efficiency, teamwork, and overall goal realization. Nwankwo and Aina (2017) support this finding, noting that delegation fosters shared responsibility and allows school heads to focus on strategic functions, thereby improving performance. The finding further aligns with Mintzberg's (1983) organizational theory, which posits that effective delegation leads to structural flexibility and improved institutional outcomes.

Table 6 indicated that involving teachers and staff in decision-making contributes positively to goal achievement, though not as strongly as delegation or committee systems. According to Eze (2019), participatory decision-making enhances morale, creativity, and sense of belonging among school personnel, which in turn improves productivity. However, the moderate correlation found may indicate limited inclusivity in decision processes within the sampled schools, supporting Ogunyemi (2021) who found that hierarchical structures in Nigerian schools often constrain collaborative governance.

Table 7 indicated a strong and significant positive relationship between the use of committee systems and goal achievement. The null hypothesis is therefore rejected. This finding suggests that the committee system serves as an effective governance mechanism for ensuring collective responsibility, policy implementation, and feedback flow in schools. It supports Afolabi and Adewale (2020) who found that committee systems improve organizational transparency and foster shared decision-making in school management. The finding also aligns with systems theory which emphasizes interdependence and collaboration among subunits for achieving institutional goals.

Overall, the findings of this study reveal that institutional governance practices have a strong and significant influence on the goal achievement of secondary education in public secondary schools in Abuja. Delegation of authority and committee systems were found to be more impactful than participatory decision-making. Furthermore, the study indicates that while communication and human relations skills are being achieved, manipulative or vocational skills remain underemphasized. This underscores the need for school administrators and policymakers to strengthen participatory governance, promote vocational education, and enhance inclusive management strategies to achieve the comprehensive goals of secondary education as stated in Nigeria's National Policy on Education.

Conclusion

The study examined the relationship between institutional governance practices and goal achievement of secondary education in public senior secondary schools in Abuja, Nigeria. The findings revealed that delegation of authority and the use of committee systems are the predominant governance practices, while participatory decision-making is least utilized. This pattern suggests that public secondary schools in Abuja still largely operate within a hierarchical administrative framework, with limited inclusivity in decision-making. The results further showed that communication and human relations skills are the major areas of goal

achievement among students, while manipulative or vocational skills remain underdeveloped. This indicates a moderate overall level of educational goal attainment, emphasizing cognitive and affective outcomes over psychomotor development.

The correlation analyses revealed strong and statistically significant relationships between institutional governance practices; particularly, delegation of authority and committee systems and goal achievement of secondary education. Participatory decision-making also showed a positive but moderate relationship, suggesting that while inclusive governance contributes positively to institutional success, it remains underutilised in practice.

In summary, effective institutional governance practices are crucial for enhancing school effectiveness and achieving the broad objectives of secondary education. Strengthening participatory structures, enhancing delegation mechanisms, and promoting vocational education are key to realising holistic educational outcomes in Abuja's public secondary schools.

Recommendations

Based on the findings, the followings were recommended:

1. School administrators should increase the level of participatory decision-making by involving teachers, non-teaching staff, and students in planning and policy implementation. This would enhance ownership, creativity, and collective responsibility in school management.
2. Principals should continue to apply effective delegation of authority to ensure efficiency, accountability, and teamwork. Training sessions and leadership workshops should be organised to improve administrators' skills in effective task delegation and supervision.
3. The Ministry of the Federal Capital Territory (FCT) Education Secretariat should encourage schools to establish functional committees for curriculum development, discipline, welfare, and co-curricular activities. This will enhance transparency, feedback, and collaborative problem-solving.
4. Policymakers should prioritise skill-oriented subjects in the secondary school curriculum to balance cognitive, affective, and psychomotor learning outcomes. Schools should partner with industries and technical institutions to improve students' practical competencies.
5. Continuous professional development programmes should be introduced for principals and vice-principals on modern governance models such as distributed and transformational leadership to promote adaptive and participatory school administration.
6. Education authorities should periodically review school governance policies to ensure alignment with Nigeria's National Policy on Education. Monitoring frameworks should be strengthened to assess how governance practices influence goal achievement at the school level.
7. Schools should adopt data-driven approaches to assess institutional performance, ensuring that governance decisions are informed by empirical evidence rather than bureaucratic tradition.

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