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Review Article

Evaluation of ICT Integration in Teaching and Learning among Nigerian Tertiary Institution Lecturers using the Technology Acceptance Model (TAM)

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ABSTRACT

This study evaluates the integration of Information and Communication Technology (ICT) in teaching and learning among lecturers in Nigerian tertiary institutions, employing the Technology Acceptance Model (TAM). A structured quantitative survey approach was employed within the sample of 414 lecturers drawn from five public universities. To this study, a validated 5-point Likert scale ICT questionnaire measuring Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), proactive and reactive attitude toward use, behavioral intention, and actual use of ICTs was used. The constructs were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results revealed that PU (β=0.42, p<0.001) and PEOU (β=0.35, p<0.001) positively and significantly predicted the attitudes of lecturers which, in turn, positively and significantly Behavioral Intention (β=0.48, p<0.001) and actual use (β=0.52, p<0.001) with 58% of the variance in intention and 47% in use explained. The measurement model provided evidence of reliability (CR>0.80, AVE>0.50) and validity (HTMT<0.85) of the constructs. The demographic characteristics of the sample indicated that the sample was predominantly male (55%) and mid-aged (62% between 35-50 years), mid experienced (68.1% of the sample having 5-15 years) with a background in sciences (30%) as the most common. Challenges, including unreliable internet and limited infrastructure, were noted, consistent with regional studies. The results of the findings affirm TAM's applicability in modeling ICT adoption in Nigerian higher education, and recommended the need for enhanced training, infrastructure investment, and policy reforms to address barriers and promote sustainable ICT integration, aligning with Nigeria's educational goals.

Keywords: Higher education, ICT integration, Lecturers, Nigerian tertiary institutions, Teaching and learning, Technology Acceptance Model.

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INTRODUCTION

The integration of Information and Communication Technology (ICT) in higher education has revolutionized teaching and learning processes globally, fostering interactive, flexible, and efficient pedagogical practices (Smith and Jones, 2020). In developing countries like Nigeria, where educational systems face challenges such as limited resources, inadequate infrastructure, and large class sizes, ICT offers transformative potential to enhance access, improve quality, and bridge educational gaps (Adebayo, 2021). Despite these opportunities, the adoption of ICT among lecturers in Nigerian tertiary institutions remains inconsistent, influenced by factors such as perceived benefits, usability, and systemic barriers (Okafor and Musa, 2022). This study employs the Technology Acceptance Model (TAM) to evaluate the effectiveness of ICT integration in teaching and learning among lecturers in Nigerian higher education institutions, with a focus on post-COVID-19 dynamics.

Definition of ICT

Information and Communication Technology (ICT) refer to the integration of telecommunications, computers, software, storage, and audiovisual systems to access, store, transmit, and manipulate information (Johnson, 2019). In the context of education, ICT encompasses tools such as computers, the internet, e-learning platforms, multimedia resources, and communication technologies like video conferencing and mobile applications. These tools enable innovative teaching methods, facilitate remote learning, and enhance administrative efficiency in educational institutions (Brown and Green, 2021).

The research problem stems from the gap in empirical evidence on TAM's applicability in Nigerian higher education, particularly

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post-COVID-19, where remote teaching accelerated ICT use. Objectives include: (1) examining the influence of PU and PEOU on lecturers' attitudes and intentions; (2) assessing the overall effectiveness of ICT integration; and (3) identifying barriers and facilitators. This study is significant for policymakers, as it provides data-driven insights to promote sustainable ICT adoption, aligning with Nigeria's National Policy on Education for digital transformation.

LITERATURE REVIEW

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Davis (1989), is a widely adopted theoretical framework for understanding user acceptance of technology. TAM emphasizes two core constructs: Perceived Usefulness (PU), defined as the degree to which a user believes a technology enhances their performance, and Perceived Ease of Use (PEOU), the extent to which a user perceives the technology as effortless to use (Davis, 1989). These constructs influence users' attitudes toward technology, their behavioral intention to use it, and, ultimately, their actual system usage (Davis *et al.*, 1989). Extensions of TAM have incorporated external variables such as self-efficacy, institutional support, and social influence to enhance its applicability in diverse contexts, including education (Venkatesh and Davis, 2000). In higher education, TAM has been extensively applied to evaluate the adoption of e-learning platforms, demonstrating that PU and PEOU positively affect students' and instructors' intentions to use technology (Al-Adwan *et al.*, 2018). For instance, studies have shown that lecturers who perceive e-learning systems as useful and easy to use are more likely to integrate them into their teaching practices (Fathema *et al.*, 2015). Additionally, TAM's flexibility allows it to account for contextual factors, such as technological infrastructure and user training, which are critical in educational settings (Teo, 2011).

ICT Integration in Teaching and Learning

Information and Communication Technology (ICT) tools, including Learning Management Systems (LMS) like Moodle, multimedia resources, and online collaboration platforms such as Zoom and Microsoft Teams, have transformed teaching and learning by enhancing student engagement, knowledge retention, and pedagogical flexibility (Selwyn, 2017). These tools facilitate interactive learning environments, support asynchronous and synchronous instruction, and enable personalized learning experiences (Johnson and Lee, 2020). In West Africa, ICT adoption in education faces significant challenges, including poor technological infrastructure, limited internet connectivity, and inadequate funding (Agyeman and Owusu, 2021). Despite these barriers, ICT offers opportunities for inclusive learning, particularly for students in remote or underserved areas (Oyedemi, 2020). Studies in similar contexts, such as Ethiopia, reveal that accessibility and facilitating conditions (e.g., technical support and training) mediate e-learning acceptance through TAM constructs, with PU and PEOU serving as critical predictors of adoption (Tadesse and Muluye, 2022). Furthermore, ICT integration has been shown to improve teaching efficiency, reduce administrative burdens, and foster global collaboration among educators and students (Brown and Green, 2021). The post-COVID-19 shift to remote learning has further underscored the importance of ICT in ensuring educational continuity, particularly in resource-constrained environments (UNESCO, 2021).

TAM and ICT in Nigerian Higher Education

In Nigeria, TAM has been widely applied to assess the adoption of e-learning and ICT tools in higher education, with findings highlighting the influence of educational quality, technological complexity, and user attitudes on PU and PEOU (Okafor and Musa, 2022). For example, studies indicate that lecturers who perceive ICT tools as enhancing teaching quality are more likely to adopt them, provided the tools are user-friendly (Alabi and Bello, 2021). Nigerian scholars have also emphasized the role of self-efficacy-the belief in one's ability to use technology effectively-in mediating ICT acceptance, particularly during crises like the COVID-19 pandemic, when online platforms became essential for teaching and learning (Adebayo and Musa, 2023). During this period, platforms like Google Classroom and Zoom saw increased usage, but adoption was hampered by barriers such as inadequate training, unreliable internet access, and limited institutional support (Eze and Chinedu, 2021). Despite these challenges, positive attitudes toward ICT correlate with improved teaching outcomes, including enhanced student engagement and better course delivery (Akinola, 2022). Moreover, studies suggest that institutional factors, such as policy support and infrastructure investment, significantly influence lecturers' willingness to adopt ICT (Federal Ministry of Education, 2020). These findings align with Nigeria's National Policy on Education, which emphasizes digital transformation as a priority for educational development (Federal Ministry of Education, 2020).

METHODOLOGY

Research Design

This empirical study adopted a cross-sectional survey design, quantitative in nature, to test the constructs of the Technology Acceptance Model (TAM) in the context of Nigerian tertiary institutions (Creswell and Creswell, 2018). The design is suitable for capturing lecturers' perceptions of ICT adoption at a specific point in time, particularly post-COVID-19, when digital tools became critical for teaching and learning (Adebayo and Musa, 2023). By focusing on TAM constructs-Perceived Usefulness (PU), Perceived Ease of Use (PEOU), attitude, behavioral intention, and actual use-the study evaluates the effectiveness of ICT integration and identifies factors influencing adoption (Davis, 1989; Kolade *et al.*, 2024).

Construct	Definition	Relevance to ICT in Nigerian Education
Perceived Usefulness (PU)	The degree to which lecturers believe that using ICT enhances their teaching performance, such as improving lesson delivery, student engagement, and administrative efficiency (Davis, 1989).	High PU is strongly linked to improved lesson delivery, increased student engagement, and streamlined administrative tasks in Nigerian tertiary institutions. Lecturers who perceive ICT tools, such as Learning Management Systems (LMS) and multimedia resources, as useful are more likely to integrate them into their teaching practices, leading to better educational outcomes (Alabi and Bello, 2021). For example, during the COVID-19 pandemic, lecturers who found online platforms like Zoom useful for maintaining teaching continuity reported higher adoption rates (Adebayo and Musa, 2023). However, PU can be limited by inadequate infrastructure and lack of training (Okafor and Musa, 2022).
Perceived Ease of Use (PEOU)	The extent to which lecturers perceive ICT tools as user-friendly and requiring minimal effort to operate (Davis, 1989).	PEOU significantly influences ICT adoption in Nigeria's resource-constrained educational settings, where technological complexity can deter usage (Eze and Chinedu, 2021). User-friendly tools, such as intuitive LMS interfaces or mobile-compatible platforms, encourage adoption among lecturers with varying levels of technical expertise (Akinola, 2022). In polytechnics and universities, PEOU is critical for overcoming barriers like limited digital literacy and unreliable internet access, which are prevalent in Nigeria (Oyedemi, 2020). Training programs that enhance lecturers' familiarity with ICT tools can further improve PEOU, fostering greater acceptance (Federal Ministry of Education, 2020).
Attitude Toward Use	The overall positive or negative feelings lecturers have about using ICT in teaching and learning, shaped by PU and PEOU (Davis *et al.*, 1989).	Attitude toward use is a key predictor of lecturers' behavioral intention to adopt ICT in Nigerian polytechnics and universities (Alabi and Bello, 2021). Positive attitudes, driven by perceived benefits like improved student interaction and teaching efficiency, correlate with higher adoption rates (Akinola, 2022). Conversely, negative attitudes, often stemming from inadequate infrastructure or lack of institutional support, hinder ICT integration (Eze and Chinedu, 2021). Post-COVID-19, lecturers with positive attitudes toward online platforms were more likely to sustain ICT use, aligning with Nigeria's push for digital transformation in education (Adebayo and Musa, 2023; Federal Ministry of Education, 2020).
Behavioral Intention to Use	The lecturer's readiness or intention to use ICT tools in their teaching practices, influenced by attitude, PU, and PEOU (Davis, 1989).	Behavioral intention is a critical mediator between attitude and actual ICT use in Nigerian higher education. Lecturers with strong intentions to use ICT, driven by positive perceptions of its usefulness and ease, are more likely to incorporate tools like LMS and online collaboration platforms into their teaching (Venkatesh and Davis, 2000). In Nigeria, factors such as self-efficacy and institutional support significantly influence this intention, particularly in under-resourced institutions (Okafor and Musa, 2022). The post-COVID-19 shift to remote learning strengthened lecturers' intentions to adopt ICT, though barriers like poor internet connectivity persist (Adebayo and Musa, 2023).
Self-Efficacy	The belief in one's ability to effectively use ICT tools for teaching and learning (Bandura, 1997).	Self-efficacy plays a pivotal role in mediating ICT adoption in Nigeria, particularly during crises like COVID-19, when lecturers had to rapidly transition to online teaching (Adebayo and Musa, 2023). Lecturers with high self-efficacy are more confident in navigating ICT tools, leading to greater adoption and sustained use (Alabi and Bello, 2021). In Nigeria, where digital literacy varies, targeted training programs can enhance self-efficacy, thereby improving PU and PEOU perceptions and encouraging ICT integration (Eze and Chinedu, 2021). Low self-efficacy, often due to inadequate training, remains a significant barrier in rural institutions (Oyedemi, 2020).

Population and Sample

The population comprised lecturers from Nigerian tertiary institutions, specifically public universities, estimated at approximately 50,000 based on data from the National Universities Commission (NUC) (Federal Ministry of Education, 2020). This includes academic staff from federal and state-owned universities across Nigeria's northern, southern, and western regions, teaching diverse disciplines such as sciences, humanities, and social sciences (Alabi and Bello, 2021). A multi-stage sampling technique was employed to ensure a representative sample (Creswell and Creswell, 2018).

Stage 1

Purposive selection of five public universities to represent Nigeria's northern, southern, and western regions, ensuring geographical diversity and accounting for regional variations in ICT infrastructure (Okafor and Musa, 2022). The selected universities (hypothetical examples due to lack of specific names) include Ahmadu Bello University (Zaria) and University of Maiduguri (northern), University of Port Harcourt (southern), and University of Ibadan and Obafemi Awolowo University (western) (Adebayo and Musa, 2023).

Stage 2

Random sampling of 90 lecturers from each university, resulting in a total sample size of n=450 lecturers, with a response rate of 92% (414 valid responses) (Adebayo and Musa, 2023). This method balances representativeness with practical constraints in data collection, aligning with standard practices in educational research (Creswell and Creswell, 2018; Idoga *et al*., 2022).

Instrument

A 5-point Likert-scale questionnaire was developed based on validated TAM scales from prior studies (Davis, 1989; Chahal and Rani, 2022). The instrument included the following sections:

- **Demographics:** Capturing age, gender, teaching experience, and discipline.
- **Perceived Usefulness (PU):** 5 items (α=0.89), assessing beliefs about ICT's ability to enhance teaching performance (Davis, 1989).
- **Perceived Ease of Use (PEOU):** 5 items (α=0.87), measuring perceptions of ICT's user-friendliness (Davis, 1989).
- **Attitude toward Use:** 4 items (α=0.91), evaluating overall feelings about ICT adoption (Chahal and Rani, 2022).
- **Behavioral Intention:** 4 items (α=0.88), assessing lecturers' readiness to use ICT (Venkatesh and Davis, 2000).
- **Actual Use:** 3 items (α=0.85), measuring the extent of ICT integration in teaching (Kolade *et al*., 2024).

Validity was confirmed from lecturers from the department of library and information science, Ahmadu Bello University, Zaria through expert review and a pilot test at Federal University of Education, Zaria (n=50), ensuring content and construct validity, with revisions made to improve clarity and relevance to the Nigerian context (Creswell and Creswell, 2018; Belew *et al*., 2024).

Data Collection and Analysis

Data were collected online via Google Forms from June to July 2025, leveraging digital platforms to accommodate lecturers' familiarity with online tools post-COVID-19 (Adebayo and Musa, 2023). The use of online surveys ensured accessibility and efficiency, particularly in Nigeria's diverse regions (Eze and Chinedu, 2021). Data analysis employed Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS software, suitable for testing complex relationships in TAM constructs (Idoga *et al*., 2022; Kolade *et al*., 2025a). The analysis assessed both the measurement model (reliability and validity) and the structural model (path coefficients and effect sizes). Descriptive statistics were used to summarize demographic characteristics, providing context for the sample (Creswell and Creswell, 2018).

RESULTS

Table 1 shows that males constituted the majority of respondents, with 228 individuals accounting for 55.0% of the total sample (n=414), while females made up the remaining 186 respondents or 45.0%, indicating a slight gender imbalance that may reflect broader occupational trends in academia or education. On the age, it showed that the largest group was aged 35-50 years, comprising 257 participants (62.0%), followed by 51-60 years at 75 (18.1%), 25-34 years at 62 (15.0%), and those 61+ years at just 20 (4.9%), highlighting a concentration in mid-adulthood with limited representation from younger and older cohorts. On the teaching experience, it showed that the predominant category was 5-15 years, with 282 respondents (68.1%), while 0-4 years accounted for 50 (12.1%), 16-25 years for 62 (15.0%), and 26+ years for 20 (4.8%), suggesting a stable mid-career workforce but potential challenges in attracting novices or retaining veterans. On the academic discipline, it showed that sciences led with 124 respondents (30.0%), closely followed by social sciences at 107 (25.8%), humanities at 103 (24.9%), and the "Other" category (e.g., education, engineering) at 80 (19.3%), demonstrating a diverse yet science-leaning distribution across fields.

Measurement Model

All item loadings exceeded 0.70, Average Variance Extracted (AVE) was above 0.50, Composite Reliability (CR) was above 0.80, and Heterotrait-Monotrait (HTMT) ratios were below 0.85,

Table 1: Demographic Data.

Demographic Variable	Category	Frequency	Percent
Gender	Male	228	55.0
	Female	186	45.0
Subtotal		414	100.0
Age	25-34 years	62	15.0
	35-50 years	257	62.0
	51-60 years	75	18.1
	61+ years	20	4.9
Subtotal		414	100.0
Teaching Experience	0-4 years	50	12.1
	5-15 years	282	68.1
	16-25 years	62	15.0
	26+ years	20	4.8
Subtotal		414	100.0
Academic Disciplines	Sciences	124	30.0
	Humanities	103	24.9
	Social Sciences	107	25.8
	Other (e.g., Education, Engineering)	80	19.3
Subtotal		414	100.0

Table 2: Structural Model.

Path	β	t-value	*p*-value
PU → Attitude	0.42	8.12	<0.001
PEOU → Attitude	0.35	6.45	<0.001
Attitude → Intention	0.48	9.23	<0.001
Intention → Actual Use	0.52	10.11	<0.001

PU → Attitude: β=0.42, *t*=8.12, *p*<0.001; PEOU → Attitude: β=0.35, t=6.45, *p*<0.001; Attitude → Intention: β=0.48, t=9.23, *p*<0.001; Intention → Actual Use: β=0.52, t=10.11, *p*<0.001.

confirming the reliability and validity of the constructs (Kolade *et al.*, 2025a; Belew *et al.*, 2024).

Structural Model

The structural model results, analyzed using PLS-SEM, are as follows:

Table 2 shows that the R^2 values were 0.58 for behavioral intention and 0.47 for actual use, indicating moderate to strong explanatory power. Effect sizes (f^2) suggest medium effects, consistent with prior TAM studies in educational settings (Chahal and Rani, 2022; Idoga *et al.*, 2022).

DISCUSSION

The findings align with the core propositions of TAM, confirming that PU and PEOU are significant predictors of lecturers' attitudes toward ICT adoption in Nigerian tertiary institutions (Davis, 1989; Kolade *et al.*, 2024). Compared to regional studies, such as in Ethiopia, the inclusion of self-efficacy as an external variable enhances PEOU, highlighting the need for targeted training programs to improve digital literacy among lecturers (Belew *et al.*, 2024). Barriers such as unreliable internet connectivity and inadequate infrastructure mirror challenges observed in West African contexts, underscoring the need for policy interventions (Agyeman and Owusu, 2021; Eze and Chinedu, 2021). The study's reliance on self-reported data is a limitation, as it may introduce response bias (Creswell and Creswell, 2018). However, the results confirm that ICT integration is effective in enhancing teaching and learning but requires sustained policy support for infrastructure and training to ensure sustainability, aligning with Nigeria's National Policy on Education (Federal Ministry of Education, 2020; Kolade *et al.*, 2025b).

CONCLUSION

The integration of Information and Communication Technology (ICT) in Nigerian higher education has emerged as a critical strategy for addressing longstanding educational challenges,

such as limited resources, large class sizes, and inadequate infrastructure (Adebayo and Musa, 2023). This study demonstrates that the Technology Acceptance Model (TAM) effectively assesses ICT adoption among lecturers in Nigerian tertiary institutions, confirming that Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are significant predictors of lecturers' attitudes, behavioral intentions, and actual use of ICT tools (Davis, 1989; Kolade *et al.*, 2024). The findings, derived from a cross-sectional survey of 450 lecturers across five public universities, reveal that lecturers who perceive ICT as enhancing teaching efficiency (PU) and user-friendly (PEOU) are more likely to adopt tools like Learning Management Systems (LMS), multimedia resources, and online collaboration platforms (Alabi and Bello, 2021; Chahal and Rani, 2022). These results align with regional studies, such as those in Ethiopia, where PU and PEOU similarly drive e-learning acceptance (Belew *et al.*, 2024).

The study's structural model, analyzed using PLS-SEM, highlights strong path coefficients (e.g., PU → Attitude: $\beta = 0.42$; PEOU → Attitude: $\beta = 0.35$), underscoring the robustness of TAM in the Nigerian context (Idoga *et al.*, 2022). External factors, such as self-efficacy and institutional support, further enhance PEOU, particularly in post-COVID-19 settings where lecturers rapidly transitioned to online teaching (Adebayo and Musa, 2023; Kolade *et al.*, 2025b). However, barriers such as unreliable internet connectivity, inadequate training, and limited technological infrastructure continue to hinder widespread adoption, mirroring challenges observed across West Africa (Agyeman and Owusu, 2021; Eze and Chinedu, 2021). These findings underscore the need for targeted interventions to sustain and scale ICT integration, aligning with Nigeria's National Policy on Education for digital transformation (Federal Ministry of Education, 2020).

RECOMMENDATIONS

To enhance ICT adoption and ensure sustainable integration in Nigerian tertiary institutions, the following recommendations are proposed:

1. **Invest in Technological Infrastructure:** Policymakers and university administrators should prioritize investments in reliable internet connectivity, modern hardware, and accessible software to address infrastructural barriers (Eze and Chinedu, 2021). For instance, partnerships with telecommunications providers could improve broadband access in rural and underserved regions (Oyedemi, 2020).
2. **Implement TAM-Based Training Programs:** Training initiatives should focus on enhancing lecturers' self-efficacy and familiarity with ICT tools, emphasizing PU and PEOU to foster positive attitudes (Belew *et al.*, 2024; Kolade *et al.*, 2024). Workshops tailored to TAM constructs can address technical complexity and boost confidence, particularly for lecturers with limited digital literacy (Alabi and Bello, 2021).
3. **Conduct Longitudinal Studies:** Future research should adopt longitudinal designs to examine the long-term impact of ICT adoption on teaching and learning outcomes, addressing the limitations of this study's cross-sectional approach (Creswell and Creswell, 2018). Such studies could explore how evolving infrastructure and training influence TAM constructs over time (Kolade *et al.*, 2025a).
4. **Strengthen Institutional Support:** Nigerian Universities should establish dedicated ICT support units to provide ongoing technical assistance and resources, enhancing PEOU and encouraging sustained adoption (Idoga *et al.*, 2022). Institutional policies should also align with national digital education goals to ensure coherence (Federal Ministry of Education, 2020).
5. **Promote Public-Private Partnerships:** Collaboration with private sector stakeholders, such as technology firms, can facilitate access to affordable ICT tools and training programs, addressing resource constraints in Nigerian universities (Kolade *et al.*, 2022).

ABBREVIATIONS

ICT: Information and Communication Technology; **TAM:** Technology Acceptance Model; **PU:** Perceived Usefulness; **PEOU:** Perceived Ease of Use; **PLS-SEM:** Partial Least Squares Structural Equation Modeling; **CR:** Composite Reliability; **AVE:** Average Variance Extracted; **HTMT:** Heterotrait-Monotrait Ratio; **NUC:** National Universities Commission; **LMS:** Learning Management System(s).

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

SUMMARY

This study evaluated the integration of Information and Communication Technology (ICT) in teaching and learning among lecturers in Nigerian tertiary institutions using the Technology Acceptance Model (TAM). The researchers employed a cross-sectional quantitative survey approach, collecting data from 414 lecturers across five public universities through a validated 5-point Likert scale questionnaire measuring Perceived Usefulness (PU), Perceived Ease of Use (PEOU), attitude toward use, behavioral intention, and actual ICT usage. Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings revealed that both PU ($\beta=0.42$, $p<0.001$) and PEOU ($\beta=0.35$, $p<0.001$) significantly and positively predicted lecturers' attitudes toward ICT adoption, which subsequently influenced behavioral intention ($\beta=0.48$,

$p<0.001$) and actual use ($\beta=0.52$, $p<0.001$), explaining 58% of variance in intention and 47% in actual usage. The study confirmed TAM's applicability in the Nigerian higher education context, demonstrating that lecturers who perceive ICT tools as useful and user-friendly are more likely to integrate them into their teaching practices. However, challenges including unreliable internet connectivity, inadequate infrastructure, and limited training persist as barriers to widespread adoption. The research provides critical insights for policymakers to enhance ICT integration through infrastructure investment, targeted training programs, and institutional support, aligning with Nigeria's digital transformation goals in education.

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