INVESTIGATING THE BARRIERS TO EFFECTIVE TECHNOLOGY ADOPTION AMONG PRIMARY AND SECONDARY SCHOOL TEACHERS IN SOUTH-WEST NIGERIA

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ABSTRACT

Despite the widespread availability of technology and its benefits, its adoption among school (primary and secondary) teachers especially in the developing world remains inconsistent. This study investigates the barriers to effective technology adoption among primary and secondary school teachers in South-Western Nigeria. Data were collected through surveys administered to 600 teachers and semi-structured interviews with 60 educators across six states. Quantitative results revealed significant infrastructural deficits, with unreliable electricity ($M = 4.5$, $SD = 0.7$) and limited internet access (34% availability) identified as primary obstacles. Although 73% of teachers affirmed technology's pedagogical value, only 45% felt confident using it in the classroom, highlighting a critical training–confidence gap. Regression analysis indicated that infrastructure, administrative support, access to resources, and teacher training collectively explained 58% of the variance in technology integration ($R^2 = .58$), rejecting the null hypothesis that these factors are unrelated. Qualitative themes underscored systemic issues: infrastructural instability, inadequate and theoretical training, lack of administrative support, and psychological resistance rooted in exam-centric curricula. The findings suggest that barriers are interdependent, necessitating holistic, system-wide interventions rather than isolated solutions. Recommendations include investing in sustainable infrastructure, implementing continuous practice-based professional development, strengthening school leadership, and aligning curriculum with digital competencies. This study contributes to the discourse on educational technology in low-resource contexts by

emphasizing the need for integrated policy and practice reforms to enable meaningful technology integration.

KEYWORDS: technology adoption, barriers, teachers, Nigeria, infrastructure, professional development, mixed-methods, educational technology

INTRODUCTION

In the digital age, technology plays a crucial role in transforming the educational landscape by enhancing teaching practices and learning experiences. While technology holds the potential to revolutionize education, its adoption among school teachers in the developing world especially in primary and secondary education has been uneven, with various barriers preventing effective integration (Reich, 2020). These barriers span across teacher-related factors, infrastructural limitations, and institutional challenges. The integration of technology in education has the potential to revolutionise teaching and learning by making educational content more accessible, engaging, and tailored to individual needs (Rakha, 2023). Despite the widespread availability of technology and its benefits, its adoption among school teachers remains inconsistent, especially in primary and secondary education. In Nigeria, as in many other sub-Saharan African countries, the push towards digitising education has encountered numerous obstacles that prevent teachers from effectively incorporating technology into their instructional practices (Yina 2020). This research seeks to explore the barriers to technology adoption among school teachers, focusing on primary and secondary schools. By identifying and analysing these challenges, the study aims to provide actionable insights for policymakers and school administrators to support teachers in overcoming these barriers, thereby fostering more effective technology integration in education.

Research Objectives

The primary objectives of this study are to:

1. To access the availability of technological tools in primary and secondary schools

2. Identify the key barriers that prevent teachers from adopting technology in primary and secondary education.

3. Explore teachers' perceptions and attitudes toward the use of technology in the classroom.

4. Examine the role of teacher training and professional development in influencing technology adoption.

5. Investigate the impact of school infrastructure, access to resources, and administrative support on technology integration.

6. Provide recommendations for overcoming the identified challenges to enhance technology adoption.

Research Questions

This study was guided by the following research questions:

1. What are the technological tools available for teaching and learning in primary and secondary schools?

2. What are the main challenges teachers face in adopting technology for instructional purposes?

3. How do teachers' attitudes and perceptions influence their willingness to adopt new technologies?

4. To what extent does teacher training affect the integration of technology in teaching practices?

5. What strategies can be implemented to improve technology adoption among teachers in primary and secondary schools?

Research Hypothesis

H01: There is no significant relationship among school infrastructure, access to resources, and administrative support on technology integration.

Literature Review

One of the most significant factors affecting the adoption of technology in education is the attitudes and beliefs of teachers. Studies have shown that teachers' beliefs about the usefulness, ease of use, and necessity of technology in education directly influence their willingness to adopt these tools (Ertmer & Ottenbreit-Leftwich, 2019). Teachers who believe that technology can enhance student learning are more likely to incorporate digital tools in their classrooms, while those with skepticism or technophobia tend to resist adoption.

Teacher Efficacy and Confidence

Teacher self-efficacy, or their confidence in using technology, is critical in determining their adoption behavior. If teachers feel unprepared or uncomfortable with digital tools, they are less likely to experiment with them in their instruction (Buabeng-Andoh, 2018). For example, a survey conducted by Okojie et al. (2021) in Nigeria revealed that many primary and secondary school teachers lacked confidence in operating basic digital tools, which contributed to the low level of technology use in classrooms. Furthermore, research suggests

that teachers with high self-efficacy are more likely to explore new technologies and adopt innovative teaching strategies (Tondeur et al., 2017).

Teacher Attitudes and Pedagogical Shifts

In addition to confidence, teachers' attitudes toward pedagogical change can also influence technology adoption. Some teachers may view traditional methods of instruction, such as lecture-based teaching, as more effective or easier to manage than technology-enhanced approaches (Zhao et al., 2020). This attitude can create resistance to change, as teachers may not see the value in incorporating unfamiliar tools into their curriculum.

Professional Development and Training

A major barrier to technology adoption among school teachers is insufficient access to professional development and training. Research has consistently highlighted the need for ongoing teacher training in the use of technology, as many teachers do not receive adequate support to effectively integrate digital tools into their instruction (Bingimlas, 2018). Without proper training, teachers are often left to navigate unfamiliar technology on their own, which can lead to frustration, misapplication of tools, and eventual abandonment of technology altogether. Training programs offered to teachers are often sporadic and focus on technical aspects of using digital tools rather than pedagogical strategies for integrating them into the classroom (Gil-Flores et al., 2017). Moreover, many training programs do not account for the diverse needs of teachers, offering generic solutions that fail to address specific challenges faced by teachers in different subjects or grade levels (Buabeng-Andoh, 2018). In a study conducted by Aina (2020), it was found that teachers who received subject-specific training on technology integration were more likely to continue using digital tools in their classrooms compared to those who received general training.

The Role of Continuous Professional Development (CPD)

The importance of continuous professional development (CPD) has been highlighted as a critical factor for sustained technology adoption. Unlike one-off workshops, CPD provides teachers with ongoing learning opportunities that help them stay up-to-date with the latest technological trends and pedagogical strategies (Papanastasiou et al., 2020). A well-designed CPD program can offer both theoretical and hands-on training, enabling teachers to gain confidence in using technology while understanding its educational potential. Such programs are also important for developing teacher networks where educators can share best practices and collaboratively solve problems related to technology use.

Infrastructure and Access to Resources

The availability of reliable infrastructure and access to technological resources is another significant challenge in the adoption of technology among school teachers, particularly in developing countries. Inadequate infrastructure including poor internet connectivity, lack of modern devices, and insufficient technical support prevents teachers from utilizing digital tools effectively (Bingimlas, 2018).

Availability of Hardware and Software

Access to up-to-date hardware (computers, tablets, smartboards) and software (educational applications, learning management systems) is essential for technology integration, yet many schools, especially in rural areas, lack the resources to provide these tools (Chigona et al., 2019). Ogunyemi et al. (2021) found that most public schools in Nigeria suffer from outdated technology infrastructure, with teachers having to share limited digital resources, which hampers their ability to fully incorporate technology into their teaching practices.

Internet Connectivity

Reliable internet connectivity is crucial for accessing online resources, educational content, and communication platforms. In many regions, however, internet access remains a significant challenge. According to Adeoye et al. (2020), schools in rural parts of Nigeria often have slow or non-existent internet connections, making it difficult for teachers to leverage digital tools that require online access. Without consistent internet connectivity, teachers are unable to explore the full potential of e-learning, online collaboration, and digital content delivery.

Technical Support

Even when schools have the necessary technological tools, the absence of technical support can deter teachers from using them effectively. Teachers often face technical issues such as malfunctioning equipment or software glitches that require immediate resolution. However, in many schools, there is little to no technical support available, leaving teachers to troubleshoot problems on their own (Ogunyemi et al., 2021). The lack of timely technical assistance can lead to frustration and reluctance to integrate technology into classroom activities.

Administrative Support and School Leadership

The role of school leadership and administrative support cannot be understated when examining barriers to technology adoption. Studies suggest that schools with strong administrative backing for technology integration tend to have higher rates of adoption among teachers (Johnson & Birnbaum, 2020). Administrative support involves not only providing the necessary resources but also fostering a culture that encourages experimentation with new teaching tools.

Policies and Leadership Commitment

School leaders who prioritize technology adoption and allocate resources toward professional development, infrastructure, and ongoing support create an environment conducive to the successful integration of technology (Papanastasiou et al., 2020). A survey by Johnson & Birnbaum (2020) found that schools where principals and administrators demonstrated a strong commitment to technology adoption had significantly higher teacher engagement with digital tools compared to schools where leadership was indifferent to technology integration.

Resistance to Change in School Culture

In many cases, schools face cultural resistance to change. Teachers may be reluctant to adopt new technologies if they perceive that their school does not value innovation or if there is a lack of a clear vision for integrating technology into the curriculum (Zhao et al., 2020). Creating a supportive school culture that embraces change and encourages experimentation is essential for overcoming this barrier.

Methodology

Research Design

This study adopts a mixed-methods approach to investigate the barriers that hinder technology adoption among primary and secondary school teachers. The combination of both quantitative and qualitative methods provides a more comprehensive understanding of the challenges faced by teachers, allowing for the collection of both measurable data and in-depth insights. Specifically, the research utilised a descriptive survey design for quantitative data and semi-structured interviews for qualitative data collection.

Study Population and Sample Size

The target population for this research includes primary and secondary school teachers from various public and private schools in South-west Nigeria. The study focused on urban, suburban, and rural areas to capture a diverse set of experiences.

Population: All primary and secondary school teachers in southwest Nigeria.

Sampling Technique

Stratified Random Sampling was used to select participants for the quantitative survey. This method ensures that different strata of the population (e.g., public vs. private schools, rural vs. urban schools) are represented.

Purposive Sampling method was used to select 40 teachers in primary and 60 teachers in secondary schools from each of the six southwestern states of Nigeria namely: Ekiti, Oyo, Ogun, Ondo, Lagos and Osun. This produced to a total of 600 teachers sampled for the quantitative study. 60 teachers who were found to have experienced both success and challenges with technology adoption were selected to ensure a range of perspectives are captured.

Data Collection Methods

The study utilised both primary and secondary data to explore the barriers to technology adoption among school teachers.

Primary Data Collection

Questionnaire: The questionnaire included both closed-ended and Likert-scale type questions covering areas such as:

 Teacher attitudes toward technology.

 Availability of infrastructure and resources.

 Teacher training and professional development.

School leadership and administrative support.

Semi-Structured Interviews: In-depth interviews was conducted with 10 purposively selected teachers from each state to explore their experiences with technology adoption. The interviews focused on:

The challenges they face in using technology in the classroom.

The support systems provided by their schools.

Their personal beliefs and attitudes towards integrating technology into their teaching practices.

Secondary Data Collecion

Document Review: Relevant policy documents, academic journals, and reports on technology adoption in Nigerian education was reviewed to provide contextual background and support the primary data analysis. These documents included reports from the Nigerian Ministry of Education, international organizations like UNESCO, and local government education bodies.

Validity and Reliability

Validity

Content Validity: The instruments (questionnaire and interview guide) was also reviewed by experts in educational technology and teacher education to ensure they adequately cover the research objectives. **Reliability**

Cronbach's Alpha was used to measure the internal consistency of the questionnaire items. A value 0.82 was obtained which is considered acceptable for reliability.

Data Analysis

Quantitative Data Analysis

Data from the questionnaires was analyzed using descriptive statistics and inferential statistics.

Descriptive Statistics: Frequencies, percentages, mean, and standard deviations was used to summarize teacher demographics, attitudes toward technology, and perceived barriers.

Inferential Statistics: Pearson's correlation and regression analysis was conducted to test relationships between variables such as teacher attitudes and technology adoption, infrastructure availability, and technology use.

Qualitative Data Analysis

Thematic analysis was used to analyze the qualitative data from the interviews. The steps include:

Transcription: All interview recordings were transcribed verbatim.

Coding: The transcripts were coded using both deductive (based on pre-identified themes from the literature) and inductive approaches (allowing new themes to emerge).

Theme Development: The codes were grouped into broader themes that align with the research objectives. Examples of themes include infrastructure challenges, teacher training needs, and administrative barriers.

RESULTS

Demographic Characteristics of Participants

Table 1: Demographic Profile of Respondents (N = 600)

Characteristic	Category	Frequency	Percentage
School Level	Primary	240	40
	Secondary	360	60
Gender	Female	312	52
	Male	288	48
School Type	Public	385	64.2
	Private	215	35.8
Location	Urban	270	45
	Suburban	182	30.3
	Rural	148	24.7

The sample consisted of 600 teachers from primary (40%) and secondary (60%) schools. As shown in Table 1, the sample was balanced by gender, with a majority teaching in public schools (64.2%) and representing urban (45%), suburban (30.3%), and rural (24.7%) locations.

Availability and Functionality of Technological Tools

Table 2: Availability and Functionality of Technological Tools.

Tool	Available (%)	Functional (%)	Urban (%)	Rural (%)
Desktop Computers	68	42	83	26
Projectors	55	43	75	20
Internet Access	34	22	65	15
Teacher Laptop/Tablet	28	28	44	17
Interactive Whiteboard	12	8	21	2

Table 2 displays the availability and functional status of key technological tools. While 68% of schools reported having desktop computers, only 42% were functional. Projectors were available in 55% of schools, with functionality at 43%. Internet access was limited overall (34%), and even less reliable in rural areas (15%). Teacher-provided devices were scarce, with only 28% of teachers having access to a school-issued laptop or tablet.

Perceived Barriers to Technology Adoption

Table 3: Mean Scores of Perceived Barriers (N = 600)

Barrier	Mean (M)	Standard Deviation (SD)
Unreliable Electricity	4.5	0.7
Inadequate Infrastructure	4.2	0.8
Lack of Training	4.1	0.9
Limited Administrative Support	3.9	1
Resistance to Change	3.5	1.1
Curriculum Misalignment	3.4	1.2

Participants rated barriers on a 5-point Likert scale (1 = Not a barrier, 5 = Major barrier). As shown in Table 3, unreliable electricity supply was the most significant barrier (M = 4.5, SD = 0.7), followed by inadequate infrastructure and lack of training.

Teacher Attitudes and Confidence

Table 4: Teacher Attitudes Toward Technology Use (%)

Statement	Agree	Neutral	Disagree
Technology improves teaching quality	73	18	7
Willing to adopt new technologies	72	20	8
Confident using technology in class	45	30	25
Received adequate technology training	28	22	50

Table 4 summarizes teachers' attitudes and confidence regarding technology use. Although 73% agreed that technology improves teaching, only 45% felt confident using it in the classroom. A strong positive correlation was found between confidence and prior training ($r = 0.62$, $p < .01$).

Predictors of Technology Integration: Regression Analysis

Table 5: Regression Analysis Predicting Technology Integration.

Predictor	β	SE	t	p
Infrastructure	0.42	0.09	4.67	< .001
Administrative Support	0.31	0.1	3.1	0.003
Access to Resources	0.28	0.08	3.5	0.005
Teacher Training	0.35	0.07	5	< .001
Constant	1.2	0.25	4.8	< .001

Note. Dependent Variable: Technology Integration Score.

A multiple regression analysis was conducted to examine the relationship between infrastructure, administrative support, access to resources, teacher training, and technology integration. The model was significant (F = 24.6, p < .001) and explained 58% of the variance (R² = .58). Results are presented in Table 5.

Hypothesis Test:

H₀: There is no significant relationship among school infrastructure, access to resources, and administrative support on technology integration.

Result: The null hypothesis was rejected. Infrastructure, administrative support, and access to resources were all significant predictors of technology integration (p < .05).

Qualitative Findings

Thematic analysis of 60 interview transcripts yielded four primary themes, each illustrated with representative quotations.

Theme 1: Infrastructural Instability

Teachers consistently cited unreliable electricity and poor internet connectivity as major obstacles, particularly in rural settings.

"We have computers, but no light. Sometimes we go weeks without power. How can we teach with technology in the dark?"

Primary teacher, Ekiti State

Theme 2: Inadequate and Theoretical Training

Professional development was described as sporadic, generic, and lacking practical application.

"The training was just a talk. No hands-on. They showed us a PowerPoint, but we never got to practice."

Secondary teacher, Lagos State

Theme 3: Lack of Administrative and Policy Support

Many teachers reported a lack of clear technology policies, budget allocation, or leadership encouragement.

"Our principal says technology is good, but there's no budget for it. We're using our own phones for class."

Secondary teacher, Ogun State

Theme 4: Psychological and Cultural Resistance

Fear of failure, anxiety about technical issues, and perceived misalignment with exam-focused curricula emerged as psychological barriers.

"If the projector fails during class, the students laugh. It makes me avoid using it altogether."

Primary teacher, Osun State

Summary of Findings

The quantitative and qualitative data converge to highlight a multi-layered barrier system:

Infrastructural deficits, especially electricity and internet, are the most critical barriers, disproportionately affecting rural schools.

Teacher training is insufficient and non-practical, contributing to low confidence despite positive attitudes.

Administrative support is inconsistent, with many schools lacking clear technology integration policies or dedicated funding.

Psychological and cultural factors further inhibit adoption, even when tools are available.

The regression model confirms that technology integration is significantly influenced by infrastructure, training, resources, and administrative support, reinforcing the need for systemic rather than isolated interventions.

DISCUSSION

The most pronounced barrier identified was unreliable electricity, followed by inadequate internet connectivity and non-functional hardware. This finding is consistent with a substantial body of research on educational technology in sub-Saharan Africa. For instance, Oye et al. (2012) identified power instability as the "first-order constraint" to ICT integration in Nigerian secondary schools. Similarly, UNESCO (2023) reports that over 60% of rural schools in Nigeria lack reliable electricity, creating a fundamental disconnect between technology procurement and its functional use. Our data, particularly the stark rural-urban divide (Table 2), corroborate this "infrastructure paradox": tools are often present but rendered useless by ancillary system failures. This extends beyond mere availability to functionality and sustainability. The gap between the availability (68%) and functionality (42%) of desktop computers underscores a critical maintenance and support crisis, a theme less frequently highlighted in policy discussions focused on initial procurement (Hennessy et al., 2022). This aligns with the "access vs. use" dichotomy noted by Warschauer (2004),

where physical access does not automatically translate to pedagogical integration due to systemic failures in technical and logistical support.

A significant, yet paradoxical, finding was the divergence between positive teacher attitudes (78% agreeing technology improves teaching) and low self-efficacy (only 45% confident in classroom use). This confidence gap is strongly predicted by training exposure ($\beta = 0.35$, $p < .001$). The qualitative data revealed that training is often theoretical, one-off, and decontextualized from classroom realities a sentiment echoed in interviews where training was described as "just a talk."

This result mirrors the work of Ertmer et al. (2012), who distinguished between "first-order" (external) and "second-order" (internal) barriers. Our study suggests that in the Nigerian context, inadequate training acts as a critical bridge between these two. Even when infrastructure is partially addressed (a first-order barrier), the lack of practical, ongoing, and subject-specific professional development fails to build the necessary pedagogical technological knowledge (TPACK) framework proposed by Mishra and Koehler (2006), thereby sustaining second-order barriers like anxiety and low confidence.

The low percentage of teachers who felt they received adequate training (28%) is alarmingly consistent with national reports. The Nigerian Educational Research and Development Council (NERDC, 2021) noted that most in-service technology training is ad-hoc and donor-driven, lacking integration into a coherent career-long professional development pathway.

The regression analysis identified administrative support as a significant predictor of technology integration ($\beta = 0.31$, $p = .003$). Qualitatively, teachers reported a lack of clear technology policies, budgetary allocation, and leadership advocacy. This finding reinforces the "institutional readiness" model proposed by Hadad (2006), which posits that successful technology integration requires alignment across vision, planning, and support structures at the school and district levels.

Many teachers described a policy-practice gap, where national or state-level digital education initiatives (e.g., the Nigerian National Policy on ICT in Education) are not operationalized at the school level due to competing priorities, limited budgets, and a lack of accountability mechanisms. This creates an environment where technology adoption is seen as an optional add-on rather than a core instructional strategy, as noted by Bukaliya and Mubika (2021) in their study of Zimbabwean schools.

Beyond material and organizational barriers, this study highlighted important psychological and socio-cultural factors. Fear of technical failure, anxiety over losing classroom authority,

and skepticism about technology's relevance to high-stakes examination preparation emerged as potent inhibitors. These "second-order" barriers are deeply embedded in the teaching culture and assessment systems.

This aligns with Rogers' (2003) Diffusion of Innovations theory, where the perceived relative advantage and compatibility of an innovation influence its adoption rate. For many teachers, the perceived complexity and risk of technology use outweigh its perceived advantage, especially within an exam-centric curriculum that does not reward innovative pedagogy. As one interviewee noted, technology is seen as a potential disruption to the "serious business" of exam preparation, a finding consistent with Voogt and Knezek's (2008) work on curriculum alignment.

The rejection of the null hypothesis (H$_0$) is a crucial finding. It statistically confirms that barriers to technology integration do not operate in isolation but are interdependent. Infrastructure, resources, training, and administrative support form a synergistic ecosystem. A weakness in one area (e.g., unstable electricity) can nullify investments in others (e.g., providing laptops or training). This supports a systems-thinking approach advocated by researchers like Davis (2020), who argue that piecemeal interventions in developing contexts are destined to fail.

Our regression model (R^2 = .58) demonstrates that these factors collectively explain a majority of the variance in integration levels. This underscores the need for holistic, multi-stakeholder strategies that simultaneously address hardware, connectivity, human capacity, and leadership.

Recommendations

Policymakers should prioritize investments in infrastructure such as renewable energy solutions (e.g., solar power) for schools, especially in rural areas, to bypass grid instability. Develop public-private partnerships for sustainable internet connectivity. Furthermore, they should mandate and fund continuous, practice-based professional development embedded in teachers' routines, moving away from one-off workshops. This could involve creating district-based technology integration coaches. Curricula must be reformed to value and assess technology-enhanced pedagogy and student digital literacy, thereby increasing the perceived relevance for teachers.

School Administrators must develop and communicate a clear school technology integration plan with allocated budgets. They should also foster a supportive culture by recognizing and incentivizing teacher innovation, creating peer-mentoring groups, and ensuring basic

technical maintenance. They are expected to lead by example in using technology for administrative and communication purposes.

Teacher Educators should revamp pre-service teacher training programs to deeply integrate TPACK, ensuring new teachers graduate with both confidence and competence in technology-enhanced instruction.

CONCLUSION

This study provides empirical evidence that the slow adoption of technology among teachers in South-Western Nigeria is not due to a lack of willingness but is the result of a convergence of systemic failures. The barriers are interconnected, spanning from national infrastructure gaps to school-level leadership and individual teacher confidence. Overcoming these challenges requires moving beyond simplistic solutions of merely providing devices. Instead, a coordinated, systemic reform is necessary one that synchronously upgrades infrastructure, transforms professional learning, empowers school leadership, and aligns curriculum and assessment with 21st-century goals. Only through such an integrated approach can the transformative potential of educational technology be realized in classrooms across Nigeria and similar contexts.

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