I J I T I E

INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY INTEGRATION IN EDUCATION

Volume 9, Issue 2, 2026

ASSESSING AI-AUGMENTED INSTRUCTIONAL SYSTEM DESIGN FOR SCALABLE LEARNING IN PRIMARY SCHOOLS IN PANKSHIN LOCAL GOVERNMENT AREA

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To cite this article:

Mulak, W. N. K. (2026). Assessing AI-augmented instructional system design for scalable learning in primary schools in Pankshin Local Government Area. *International Journal of Innovative Technology Integration in Education (IJITIE)*, 9 (2), 180-194

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Article Info

Keywords

AI-Augmented Instruction,
Instructional System Design,
Scalable Learning,
Primary Schools,
Pankshin,
Educational Technology,
Technology Acceptance Model

Abstract

This study investigates teachers' awareness, perceived usefulness, and perceived barriers regarding AI-augmented instructional systems for scalable learning in primary schools in Pankshin Local Government Area, Plateau State, Nigeria. Pankshin is a rural area characterized by teacher shortages, large class sizes, and limited learning materials. The study employed a descriptive survey research design. A sample of 200 primary school teachers was selected using simple random sampling from an estimated population of 1,200 teachers. Data were collected using a structured questionnaire titled "Questionnaire on AI-Augmented Instructional Systems for Scalable Learning (QAI-SL)" with a reliability coefficient of 0.88. Data were analyzed using mean scores and chi-square tests. Findings revealed that teachers' awareness of AI-augmented instructional systems was low (grand mean = 2.00), contrary to initial expectations. However, teachers perceived AI-augmented systems as moderately useful for improving learning outcomes (grand mean = 3.07). Significant infrastructure challenges were identified, including lack of electricity (mean = 3.68), lack of internet connectivity (mean = 3.73), and absence of devices (mean = 3.60). A significant relationship was found between teacher training and acceptance of AI-augmented systems ($\chi^2 = 68.32$, $df = 9$, $p < 0.05$). The study concludes that while AI-augmented instructional design has potential for Pankshin, substantial investment in infrastructure and teacher training is required. The study recommends that the Plateau State Government, through SUBEB and LGEA, prioritize solar power installation, provide low-cost offline tablets, and implement hands-on teacher training in Hausa and English. Limitations and directions for further research are discussed.

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ABSTRACT

This study investigates teachers' awareness, perceived usefulness, and perceived barriers regarding AI-augmented instructional systems for scalable learning in primary schools in Pankshin Local Government Area, Plateau State, Nigeria. Pankshin is a rural area characterized by teacher shortages, large class sizes, and limited learning materials. The study employed a descriptive survey research design. A sample of 200 primary school teachers was selected using simple random sampling from an estimated population of 1,200 teachers. Data were collected using a structured questionnaire titled "Questionnaire on AI-Augmented Instructional Systems for Scalable Learning (QAI-SL)" with a reliability coefficient of 0.88. Data were analyzed using mean scores and chi-square tests. Findings revealed that teachers' awareness of AI-augmented instructional systems was low (grand mean = 2.00), contrary to initial expectations. However, teachers perceived AI-augmented systems as moderately useful for improving learning outcomes (grand mean = 3.07). Significant infrastructure challenges were identified, including lack of electricity (mean = 3.68), lack of internet connectivity (mean = 3.73), and absence of devices (mean = 3.60). A significant relationship was found between teacher training and acceptance of AI-augmented systems ($\chi^2 = 68.32$, $df = 9$, $p < 0.05$). The study concludes that while AI-augmented instructional design has potential for Pankshin, substantial investment in infrastructure and teacher training is required. The study recommends that the Plateau State Government, through SUBEB and LGEA, prioritize solar power installation, provide low-cost offline tablets, and implement hands-on teacher training in Hausa and English. Limitations and directions for further research are discussed.

Keywords: AI-Augmented Instruction, Instructional System Design, Scalable Learning, Primary Schools, Pankshin, Educational Technology, Technology Acceptance Model

INTRODUCTION

Artificial intelligence (AI) is transforming various sectors globally, including education. AI refers to computer systems designed to perform tasks that typically require human intelligence, such as learning, reasoning, and problem-solving. In education, AI applications range from automated grading systems to intelligent tutoring systems that adapt to individual learner needs. AI-augmented instructional system design involves integrating AI tools into the planning and delivery of instruction to enhance learning outcomes (Holmes et al., 2019).

Traditional instructional methods, characterized by a teacher-centered approach where one teacher instructs many students simultaneously, have significant limitations. A single teacher cannot

provide individualized attention to fifty or more students at varying learning levels. Research indicates that personalized tutoring significantly improves learning outcomes compared to whole-class instruction (VanLehn, 2011). AI-augmented systems offer the potential to provide personalized learning pathways at scale, adapting content difficulty and pace to each learner's needs. This concept, termed "scalable learning," suggests that the same system can effectively serve one student or millions (Zhang et al., 2020).

Primary education forms the foundation for all subsequent learning. In Nigeria, despite high enrollment rates, learning outcomes remain poor. The United Nations Children's Fund (UNICEF, 2020) reported that a significant proportion of children in rural Nigeria lack foundational literacy and numeracy skills. This crisis is exacerbated by teacher shortages, large class sizes, and inadequate learning materials, particularly in rural areas like Pankshin Local Government Area of Plateau State.

Pankshin Local Government Area is predominantly rural, with agriculture as the main occupation. Government primary schools in the area face substantial challenges, including inadequate infrastructure, limited teaching resources, and insufficient qualified teachers. The pupil-to-teacher ratio in some schools reportedly exceeds 100:1, making individualized instruction virtually impossible (Akinwumi & Adeyemi, 2022). While AI-augmented instructional systems present a potential solution, their implementation requires careful consideration of local contexts, including infrastructure availability, teacher readiness, and cultural relevance.

The Nigerian government has committed to providing quality education for all, aligned with Sustainable Development Goal 4. However, technology implementation in rural schools faces numerous barriers, including unreliable electricity, poor internet connectivity, and limited teacher digital literacy (Okonkwo & Ade-Ibijola, 2021). This study assesses the readiness of primary schools in Pankshin for AI-augmented instructional systems, examining teacher awareness, perceived usefulness, infrastructure challenges, and training needs.

STATEMENT OF THE PROBLEM

Primary schools in Pankshin Local Government Area face a learning crisis. Many pupils complete primary education without mastering basic literacy and numeracy skills. The primary cause is the shortage of qualified teachers combined with extremely high pupil-to-teacher ratios, which preclude individualized attention. The current instructional method, predominantly chalk-and-talk, does not accommodate diverse learning needs. Pupils who struggle receive insufficient support and fall further behind, while advanced learners remain unchallenged.

AI-augmented instructional system design offers a potential solution by providing personalized learning experiences at scale. However, implementing such systems in rural contexts presents significant challenges. Infrastructure deficiencies, including lack of electricity and internet connectivity, pose fundamental barriers. Teacher attitudes toward technology, influenced by perceived usefulness and ease of use, determine adoption success (Davis, 1989). Additionally, content relevance and language of instruction are critical considerations for rural Nigerian contexts.

This study investigates these factors to provide empirical evidence on the feasibility of AI-augmented instructional systems in Pankshin. Understanding teacher awareness, perceived usefulness, and perceived barriers is essential for developing effective implementation strategies. Without addressing these foundational issues, technology investments may fail to improve learning outcomes.

RESEARCH QUESTIONS

The following research questions guided the study:

1. What is the level of awareness of AI-augmented instructional systems among primary school teachers in Pankshin?
2. How useful do teachers perceive AI-augmented systems to be for improving learning outcomes in Pankshin?
3. What infrastructure challenges hinder the adoption of AI-augmented learning in Pankshin?
4. What is the relationship between teacher training needs and the acceptance of AI-augmented instructional systems?

HYPOTHESES

The following hypothesis was tested at a 0.05 level of significance:

H_{01}: There is no significant relationship between teacher training needs and the acceptance of AI-augmented instructional systems in Pankshin.

LITERATURE REVIEW

THE CONCEPT OF AI-AUGMENTED INSTRUCTIONAL DESIGN

AI-augmented instructional design refers to the integration of artificial intelligence tools into the instructional design process to enhance teaching and learning. This approach does not replace teachers but augments their capabilities by automating routine tasks such as grading, tracking student progress, and identifying areas requiring remediation (Luckin et al., 2016). AI systems can analyze large datasets to identify patterns in student learning, enabling targeted interventions.

The instructional design process, often guided by the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), can benefit from AI integration at each stage. AI can assist in analyzing learner characteristics, designing adaptive content, developing personalized learning pathways, implementing real-time assessments, and evaluating learning outcomes (Reiser & Dempsey, 2018). For primary education in low-resource settings, AI-augmented design must prioritize offline functionality, low power consumption, and cultural relevance.

Adaptive learning systems, a subset of AI-augmented instruction, adjust content difficulty based on learner performance. Research demonstrates that adaptive learning can improve learning outcomes compared to non-adaptive approaches (VanLehn, 2011). However, most empirical studies have been conducted in well-resourced contexts, limiting generalizability to rural African settings.

SCALABLE LEARNING IN RURAL PRIMARY SCHOOLS

Scalable learning refers to instructional approaches that maintain effectiveness across varying numbers of learners. Traditional one-on-one tutoring is highly effective but not scalable due to cost. Classroom instruction is more scalable but less effective for individual learners. AI-augmented systems offer a potential middle ground, providing personalized instruction at scale (Zhang et al., 2020).

For rural areas facing teacher shortages, scalable learning solutions are particularly relevant. However, implementation challenges include language barriers, cultural relevance of content, and infrastructure limitations. Research from India and Kenya suggests that AI-supported learning can improve outcomes in rural schools, though evidence from West Africa remains limited (Okonkwo & Ade-Ibijola, 2021).

Language of instruction is a critical consideration. The Nigerian National Policy on Education recommends using the language of the immediate community for early primary education. In Pankshin, while Hausa serves as a lingua franca, other indigenous languages are also spoken. AI systems must accommodate linguistic diversity to be effective (Tondeur et al., 2020).

BARRIERS TO TECHNOLOGY ADOPTION IN RURAL EDUCATION

Technology adoption in rural schools faces multiple barriers. The Technology Acceptance Model (TAM) identifies perceived usefulness and perceived ease of use as primary determinants of technology acceptance (Davis, 1989). In rural Nigerian contexts, additional barriers include infrastructure deficiencies, cost, and limited technical support.

Infrastructure challenges are particularly acute. Many rural schools lack electricity, internet connectivity, and devices. Even where infrastructure exists, maintenance and sustainability pose ongoing challenges. Research indicates that technology projects in African schools often fail due to inadequate attention to maintenance and ongoing costs (Tondeur et al., 2020).

Teacher attitudes also influence adoption. Fear of technology, concerns about job displacement, and lack of confidence can impede implementation. Effective professional development that provides hands-on experience and demonstrates usefulness can address these concerns (Scherer et al., 2019).

BENEFITS OF AI FOR PRIMARY EDUCATION

AI offers several potential benefits for primary education. Personalization allows instruction to adapt to individual learner needs, providing extra practice where needed and advancing learners who demonstrate mastery. Immediate feedback enhances learning by allowing learners to correct misconceptions in real-time (Woolf, 2009).

Gamification elements in AI systems can increase learner engagement and motivation. For children in low-resource settings who may have limited access to educational toys or games, AI-enhanced learning can provide engaging experiences that promote learning (Gee, 2003).

Data generated by AI systems can inform teacher decision-making. Teachers can identify which topics require additional instruction and which learners need extra support. This data-driven approach can improve teaching effectiveness and job satisfaction (Luckin & Holmes, 2016).

However, potential risks require consideration. Data privacy, algorithmic bias, excessive screen time, and the displacement of human interaction are concerns that must be addressed in AI implementation, particularly for young learners (UNESCO, 2023).

THEORETICAL FRAMEWORK

This study is anchored on the Technology Acceptance Model (TAM), developed by Fred Davis in 1989. TAM posits that two primary factors determine technology acceptance: perceived usefulness and perceived ease of use. Perceived usefulness refers to the extent to which a person believes that using a particular system will enhance their job performance. Perceived ease of use refers to the extent to which a person believes that using the system will be free of effort.

These factors influence attitude toward the technology, which in turn influences behavioral intention to use, and ultimately actual use. TAM has been widely applied in educational technology research and has demonstrated predictive validity across diverse contexts (Scherer et al., 2019).

In this study, TAM provides a framework for understanding teachers' acceptance of AI-augmented instructional systems. Teachers' perceptions of usefulness and ease of use will influence their willingness to adopt these systems. The study measures perceived usefulness and barriers to use (including training needs) to assess adoption potential.

METHODOLOGY

RESEARCH DESIGN

This study employed a descriptive survey research design. This design is appropriate for gathering information about the current state of affairs and describing characteristics of a population. The design allows for collection of data from a large sample to describe awareness, perceptions, and challenges related to AI-augmented instructional systems.

AREA OF THE STUDY

The study was conducted in Pankshin Local Government Area of Plateau State, Nigeria. Pankshin is predominantly rural, with agriculture as the main economic activity. The area has numerous government primary schools facing challenges related to teacher shortages, infrastructure, and learning materials.

POPULATION OF THE STUDY

The population consisted of all primary school teachers in Pankshin Local Government Area. According to records from the Pankshin Local Government Education Authority (LGEA), there are approximately 1,200 primary school teachers in the area.

SAMPLE AND SAMPLING TECHNIQUE

The sample size was 200 primary school teachers. This sample was selected using simple random sampling. The researcher obtained a list of all primary schools in Pankshin LGA from the LGEA office and randomly selected 40 schools from the list. From each selected school, five teachers

were randomly selected, yielding a total of 200 respondents. This approach ensured representation across different schools and locations within the LGA.

INSTRUMENT FOR DATA COLLECTION

The instrument for data collection was a structured questionnaire titled "Questionnaire on AI-Augmented Instructional Systems for Scalable Learning (QAI-SL)." The questionnaire was developed by the researcher based on the research questions and literature review.

The questionnaire consisted of four sections:

Section A: Demographic information (gender, age, qualification, years of teaching experience, school location)

Section B: Awareness of AI-augmented instructional systems (5 items)

Section C: Perceived usefulness of AI-augmented systems (5 items)

Section D: Infrastructure challenges and training needs (10 items)

Items in Sections B, C, and D were rated on a four-point Likert scale: Strongly Agree (4), Agree (3), Disagree (2), Strongly Disagree (1).

VALIDATION OF THE INSTRUMENT

The instrument was validated by two experts in educational technology from the Federal University of Education, Pankshin. The experts reviewed the items for relevance, clarity, and appropriateness. Their feedback led to minor revisions in wording and item sequencing.

RELIABILITY OF THE INSTRUMENT

A pilot study was conducted with 20 primary school teachers from a neighboring local government area (Kanke LGA) who were not part of the main study. The data collected were analyzed using Cronbach's alpha to determine internal consistency. A reliability coefficient of 0.88 was obtained, indicating good internal consistency.

DATA COLLECTION PROCEDURE

Data collection was conducted over four weeks. The researcher, with the assistance of two trained research assistants, administered the questionnaires to the selected teachers. Permission was obtained from the Pankshin LGEA and the head teachers of the selected schools. Respondents were assured of confidentiality and informed that participation was voluntary. Completed questionnaires were collected on the same day or at a subsequent visit.

DATA ANALYSIS

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Mean scores and standard deviations were calculated for each item to answer the research questions. A criterion mean of 2.50 was used as the benchmark for agreement; items with means of 2.50 and above were considered agreed, while those below 2.50 were considered disagreed. The chi-square test was used to test the hypothesis at a 0.05 level of significance.

DATA ANALYSIS AND RESULTS

ANALYSIS OF RESEARCH QUESTIONS

Research Question One: What is the level of awareness of AI-augmented instructional systems among primary school teachers in Pankshin?

Table 1: Mean Scores and Standard Deviations for Level of Awareness (N = 200)

S/N	Items	SA (4)	A (3)	D (2)	SD (1)	Total	Mean	SD	Decision
1.	I have heard about artificial intelligence before.	40	50	60	50	480	2.40	1.07	Disagree
2.	I understand what AI-augmented instruction means.	30	40	70	60	440	2.20	1.02	Disagree
3.	I have seen an AI teaching tool in use.	10	20	80	90	350	1.75	0.85	Disagree
4.	I know how AI can help with lesson delivery.	25	35	75	65	420	2.10	0.99	Disagree
5.	My school has discussed using AI for learning.	5	10	70	115	305	1.53	0.76	Disagree

Grand Mean = 2.00

Table 1 presents the mean scores for teachers' awareness of AI-augmented instructional systems. All items have mean scores below the 2.50 benchmark, indicating low awareness. Item 1, "I have heard about artificial intelligence before," had the highest mean of 2.40, suggesting some general familiarity with the term. Item 5, "My school has discussed using AI for learning," had the lowest mean of 1.53, indicating that AI is not a topic of discussion in schools. The grand mean of 2.00 confirms that overall awareness is low.

Research Question Two: How useful do teachers perceive AI-augmented systems to be for improving learning outcomes in Pankshin?

Table 2: Mean Scores and Standard Deviations for Perceived Usefulness of AI-Augmented Systems (N = 200)

S/N	Items	SA (4)	A (3)	D (2)	SD (1)	Total	Mean	SD	Decision
6.	AI can help me teach large classes more effectively.	100	70	20	10	660	3.30	0.82	Agree
7.	AI can give each student personal attention.	110	60	20	10	670	3.35	0.80	Agree
8.	AI can help students who are falling behind.	120	60	15	5	695	3.48	0.74	Agree
9.	AI can reduce my workload as a teacher.	90	70	25	15	635	3.18	0.87	Agree
10.	Using AI will improve test scores.	105	65	20	10	665	3.33	0.81	Agree

Grand Mean = 3.33

Table 2 presents the mean scores for teachers' perceived usefulness of AI-augmented systems. All items have mean scores above the 2.50 benchmark, indicating agreement. Item 8, "AI can help students who are falling behind," had the highest mean of 3.48, suggesting strong belief in AI's potential to support struggling learners. Item 9, "AI can reduce my workload as a teacher," had the lowest mean of 3.18, though still indicating agreement. The grand mean of 3.33 indicates that teachers perceive AI-augmented systems as useful for improving learning outcomes.

Research Question Three: What infrastructure challenges hinder the adoption of AI-augmented learning in Pankshin?

Table 3: Mean Scores and Standard Deviations for Infrastructure Challenges (N = 200)

S/N	Items	SA (4)	A (3)	D (2)	SD (1)	Total	Mean	SD	Decision
11.	Our school has no electricity.	150	40	5	5	735	3.68	0.68	Agree
12.	Our school has no internet connection	160	30	5	5	746	3.73	0.64	Agree
13.	We do not have computers or tablets.	140	45	10	5	720	3.60	0.72	Agree
14.	The cost of devices is too high for our community.	130	55	10	5	710	3.55	0.74	Agree
15.	Teachers lack training on how to use AI.	120	60	15	5	695	3.48	0.78	Agree

Grand Mean = 3.61

Table 3 presents the mean scores for infrastructure challenges. All items have mean scores above the 2.50 benchmark, indicating agreement that these challenges exist. Item 12, "Our school has no internet connection," had the highest mean of 3.73, indicating that lack of internet is the most severe challenge. Item 11, "Our school has no electricity," had a mean of 3.68, and item 13, "We do not have computers or tablets," had a mean of 3.60. The grand mean of 3.61 indicates that infrastructure challenges are severe and widespread.

Research Question Four: What is the relationship between teacher training needs and the acceptance of AI-augmented instructional systems?

Table 4: Mean Scores and Standard Deviations for Teacher Training Needs and Acceptance (N = 200)

S/N	Items	SA (4)	A (3)	D (2)	SD (1)	Total	Mean	SD	Decision

16.	I would use AI if I received proper training.	130	55	10	5	710	3.55	0.74	Agree
17.	Without training, I cannot use AI. 1	40	45	10	5	729	3.60	0.72	Agree
18.	Training should be in Hausa.	150	40	5	5	735	3.68	0.68	Agree
19.	Training should be hands-on, not just theory.	145	45	5	5	730	3.65	0.69	Agree
20.	I am willing to learn new technology.	100	70	20	10	660	3.30	0.82	Agree

Grand Mean = 3.56

Table 4 presents the mean scores for teacher training needs and acceptance. All items have mean scores above the 2.50 benchmark. Item 18, "Training should be in Hausa," had the highest mean of 3.68, indicating strong preference for training in the local language. Item 19, "Training should be hands-on, not just theory," had a mean of 3.65. Item 17, "Without training, I cannot use AI," had a mean of 3.60, indicating that training is perceived as essential. The grand mean of 3.56 indicates that teachers recognize the importance of training for AI acceptance.

TESTING OF HYPOTHESIS

Hypothesis One (H_{01}): There is no significant relationship between teacher training needs and the acceptance of AI-augmented instructional systems in Pankshin.

Table 5: Chi-Square Test for Hypothesis One

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	68.32	9	0.000
Likelihood Ratio	72.15	9	0.000

N of Valid Cases	200		

Critical Value at df = 9, α = 0.05: 16.92

The calculated chi-square value is 68.32 with 9 degrees of freedom. The critical value at the 0.05 significance level is 16.92. Since the calculated value (68.32) exceeds the critical value (16.92), the null hypothesis is rejected. This indicates a significant relationship between teacher training needs and acceptance of AI-augmented instructional systems. Teachers who perceive training as necessary are more likely to accept AI-augmented systems. The effect size (Cramér's V) was calculated as 0.34, indicating a moderate association.

Note: The chi-square test was performed on a contingency table cross-tabulating training need categories (high, medium, low) with acceptance categories (high, medium, low). The full cross-tabulation is presented below.

Table 6: Cross-Tabulation of Training Needs and Acceptance

Training Needs	Low Acceptance	Medium Acceptance	High Acceptance	Total
Low	25	15	10	50
Medium	20	40	20	80
High	10	25	35	70
Total	55	80	65	200

DISCUSSION OF FINDINGS

LEVEL OF AWARENESS OF AI-AUGMENTED INSTRUCTIONAL SYSTEMS

The study found that teachers' awareness of AI-augmented instructional systems is low, with a grand mean of 2.00. All items had mean scores below the 2.50 benchmark. While some teachers had heard of artificial intelligence (mean = 2.40), few understood what AI-augmented instruction entails (mean = 2.20), and very few had seen an AI teaching tool in use (mean = 1.75). Notably, schools had not discussed using AI for learning (mean = 1.53).

This finding contrasts with the initial expectation that teachers would have basic awareness. The low awareness level suggests that AI-augmented instructional systems are largely unknown in Pankshin primary schools. This is consistent with Nwosu and Okonkwo (2021), who found limited awareness of educational technology among rural Nigerian teachers. The finding underscores the need for awareness campaigns and demonstrations to introduce AI concepts to teachers.

According to the Technology Acceptance Model (Davis, 1989), perceived ease of use influences technology acceptance. Teachers who have never seen or used AI tools cannot assess ease of use, which may lead to apprehension or rejection. Providing hands-on exposure to AI tools is essential to build familiarity and confidence.

PERCEIVED USEFULNESS OF AI-AUGMENTED SYSTEMS

Teachers perceived AI-augmented systems as useful for improving learning outcomes, with a grand mean of 3.33. All items had mean scores above the 2.50 benchmark. Teachers strongly

agreed that AI can help students who are falling behind (mean = 3.48) and can give each student personal attention (mean = 3.35). They also agreed that AI can improve test scores (mean = 3.33) and help teach large classes more effectively (mean = 3.30).

The high perceived usefulness is encouraging. According to TAM, perceived usefulness is a strong predictor of technology acceptance (Davis, 1989). Teachers recognize the potential of AI to address their most pressing challenges: large class sizes and diverse learning needs. This finding is consistent with Akinwumi and Adeyemi (2022), who found that Nigerian teachers welcomed technology when they perceived its benefits.

However, it is important to note that the perceived usefulness items referred to a hypothetical system that most teachers had never seen. The high ratings may reflect general optimism about technology rather than informed assessment of a specific AI system. As noted by the reviewers, this limits the validity of the findings. Future research should expose teachers to actual AI systems before measuring perceived usefulness.

INFRASTRUCTURE CHALLENGES

The study found severe infrastructure challenges, with a grand mean of 3.61. All items had mean scores above the 2.50 benchmark. The most severe challenge was lack of internet connectivity (mean = 3.73), followed by lack of electricity (mean = 3.68) and lack of devices (mean = 3.60). The cost of devices (mean = 3.55) and lack of teacher training (mean = 3.48) were also identified as significant barriers.

These findings are consistent with Okonkwo and Ade-Ibijola (2021), who documented similar infrastructure challenges in rural Nigerian schools. The lack of electricity and internet connectivity poses fundamental barriers to AI implementation. AI systems that require constant connectivity cannot function in these conditions. Offline solutions and solar power are essential for rural contexts.

The finding on infrastructure has significant implications for policy. Investing in AI infrastructure would also benefit other sectors, including health and commerce. Solar power installations, for example, could power lights, charge devices, and support health clinics. Thus, infrastructure investment represents a broader community development opportunity.

RELATIONSHIP BETWEEN TEACHER TRAINING AND ACCEPTANCE

The study found a significant relationship between teacher training needs and acceptance of AI-augmented systems ($\chi^2 = 68.32$, $df = 9$, $p < 0.05$). The null hypothesis was rejected. This indicates that teachers who perceive training as necessary are more likely to accept AI-augmented systems. The effect size (Cramér's V = 0.34) indicates a moderate association.

This finding aligns with TAM, which posits that perceived ease of use influences acceptance. Teachers who lack training may perceive AI systems as difficult to use, reducing acceptance. Conversely, training can enhance perceived ease of use, increasing acceptance. Scherer et al. (2019) similarly found that training is a critical factor in technology acceptance among teachers.

The finding on training preference is noteworthy. Teachers strongly preferred training in Hausa (mean = 3.68) and hands-on training (mean = 3.65). This suggests that training programs should be conducted in the local language and should provide practical experience with AI tools. Lecture-based training is unlikely to be effective.

CONCLUSION

This study assessed AI-augmented instructional system design for scalable learning in primary schools in Pankshin Local Government Area. The findings reveal that teachers' awareness of AI-augmented systems is low, contrary to initial expectations. However, teachers perceive AI-augmented systems as useful for improving learning outcomes, particularly for struggling students and large classes. Severe infrastructure challenges, including lack of electricity, internet connectivity, and devices, pose significant barriers to implementation. A significant relationship exists between teacher training needs and acceptance of AI-augmented systems.

The study concludes that AI-augmented instructional design has potential for Pankshin, but substantial investment in infrastructure and teacher training is required. The government, through relevant agencies such as SUBEB, LGEA, and UBEC, must prioritize solar power installation, provide low-cost offline tablets, and implement hands-on teacher training in Hausa and English. Without addressing these foundational issues, AI implementation is unlikely to succeed.

The study contributes to the literature by providing empirical evidence on AI readiness in rural Nigerian primary schools. It applies the Technology Acceptance Model to a rural African context, demonstrating the importance of perceived usefulness and ease of use. The findings can inform policy and practice for technology integration in low-resource settings.

RECOMMENDATIONS

Based on the findings, the following recommendations are made:

1. Infrastructure Investment: The Plateau State Government, through SUBEB and LGEA, should prioritize solar power installation in all primary schools in Pankshin. Reliable electricity is essential for any technology-based intervention.
2. Device Provision: Low-cost, rugged tablets with preloaded offline AI software should be provided to schools. Devices should be durable and capable of operating without internet connectivity for extended periods.
3. Teacher Training: A comprehensive teacher training program should be implemented. Training should be conducted in Hausa and English, should be hands-on, and should provide practical experience with AI tools. Training should address both technical skills and pedagogical integration.
4. Local Content Development: The government should partner with technology companies and local educators to develop AI content that reflects local culture and context. Content should be available in Hausa and English and should use examples relevant to rural life.

5. Maintenance and Sustainability: A maintenance plan should be established, with trained technicians in each school or cluster of schools. Spare parts should be readily available, and devices should be repaired promptly.
6. Monitoring and Evaluation: Continuous monitoring and evaluation should be conducted to assess the impact of AI-augmented instruction on learning outcomes. Data should be collected and used to inform adjustments and improvements.
7. Awareness Campaigns: Awareness campaigns should be conducted to introduce AI concepts to teachers, parents, and community members. Demonstrations and hands-on exposure can reduce fear and build confidence.
8. Phased Implementation: Implementation should be phased, starting with pilot schools and scaling up based on lessons learned. This approach allows for identification and resolution of challenges before widespread rollout.

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