

Assessment on Integrating Artificial Intelligence Tools for ... Mustapha, M. (2026)

Assessment on Integrating Artificial Intelligence Tools for Basic Science and Technology Teaching among Junior Secondary School Teachers in Daura, Katsina State, Nigeria

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Abstract

The integration of Artificial Intelligence (AI) into education has the potential to improve instructional delivery and students' learning outcomes. However, its adoption in Nigerian junior secondary schools remains limited, particularly in rural areas. This study examined the integration of AI tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State. Specifically, the study determined teachers' awareness and readiness to integrate AI tools, assessed the availability of AI instructional resources and challenges affecting their integration, and examined the perceived benefits of AI in teaching. A descriptive survey research design was adopted. The population comprised 124 Basic Science and Technology teachers, from which 95 respondents were selected using simple random sampling. Data were collected using the Artificial Intelligence Integration Questionnaire (AIIQ), which yielded a Cronbach's Alpha reliability coefficient of 0.82. Mean and standard deviation were used to answer the research questions, while independent samples t-test and Pearson Product Moment Correlation were used to test the hypotheses at the 0.05 level of significance. The findings revealed high teachers' awareness and readiness to integrate AI tools despite inadequate instructional facilities and infrastructural challenges. Teachers perceived AI as beneficial for improving instructional delivery and students' learning. The study recommends improved digital infrastructure, teacher training, and supportive educational policies to enhance AI integration.

Keywords: Artificial Intelligence, Basic Science and Technology, AI integration, teacher readiness.

Introduction

Digital growth is rapidly reshaping education, especially through the use of Artificial Intelligence (AI). AI refers to computer systems designed to model human problem solving, decision making, and learning (Kamalov et al., 2023). Today, tools like virtual labs, smart tutoring systems, adaptive software, and educational chatbots are recognized globally for their ability to improve teaching and learning (Younas et al., 2025). Studies show that AI effectively supports personalized learning, boosts student engagement, and helps teachers deliver better lessons (Holmes et al., 2019). Developed nations are already ahead, actively weaving AI into STEM (Science, Technology, Engineering, and Mathematics) classrooms to drive innovation and digital literacy. These countries use AI tools to tailor lessons to individual needs and prepare students with the technical skills the future job market demands (Naseri & Abdullah, 2025). However, the story is quite different in developing countries where AI adoption is slow due to poor internet connectivity, lack of basic technological resources, and a lack of training for teachers (Bali et al., 2024). In Nigeria, these issues are hit hard by broader challenges like poor school funding, missing instructional materials, and an unequal access to technology that leaves rural schools behind (Abimbola et al., 2025). This tech gap directly impacts foundational subjects like Basic Science and Technology. According to the Nigerian Educational Research and Development Council (NERDC), this subject is meant to build early scientific literacy and problem-solving skills, which requires practical and interactive teaching. AI could easily bridge this gap by offering virtual science labs, automated grading, smart tutoring, and learning platforms that adapt to a student's pace (Porayska-Pomsta et al., 2023). Yet, despite these clear benefits, the actual use of AI tools in Nigerian science classrooms remains very low. The reality is that teachers face constant power outages, a lack of working computers, and their own low digital confidence because they have not been trained on how to use AI for teaching (Agwom et al., 2025).

Statement of the Problem

Artificial Intelligence (AI) has the potential to transform the teaching of Basic Science and Technology by promoting interactive learning, improving instructional delivery, and supporting personalized learning experiences. Despite these potentials, the extent to which AI tools have been integrated into the teaching of Basic Science and Technology in public junior secondary schools, particularly in rural areas, remains uncertain. In Daura Local Government Area of Katsina State, classroom instruction in Basic Science and Technology appears to rely largely on conventional teaching methods, with limited evidence of AI-supported instructional practices. The apparent inadequacy of digital instructional facilities, coupled

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with possible variations in teachers' awareness and readiness to utilize AI tools, may hinder efforts to improve science teaching and learning in line with current technological advancements. Consequently, students may continue to experience limited exposure to innovative instructional approaches capable of enhancing scientific understanding, critical thinking, and digital literacy.

Objectives of the Study

The objectives of this study are to:

1. Determine teachers' awareness and readiness to integrate Artificial Intelligence tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.
2. Examine the availability of Artificial Intelligence instructional tools and the challenges affecting their integration in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.
3. Examine the perceived benefits of integrating Artificial Intelligence tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.

Research Questions

1. What is the level of teachers' awareness and readiness to integrate Artificial Intelligence tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State?
2. To what extent are Artificial Intelligence instructional tools available, and what challenges affect their integration in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State?
3. What are the perceived benefits of integrating Artificial Intelligence tools in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State?

Research Hypotheses

- H₀₁:** There is no significant difference in teachers' awareness and readiness to integrate Artificial Intelligence tools based on teaching experience in junior secondary schools in Daura Local Government Area, Katsina State.
- H₀₂:** There is no significant difference between the availability of Artificial Intelligence instructional tools and their integration in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.
- H₀₃:** There is no significant difference in teachers' perceptions of the benefits of integrating Artificial Intelligence tools based on gender in junior secondary schools in Daura Local Government Area, Katsina State.

Research Methodology

The study adopted a descriptive survey research design, which was considered appropriate for investigating the integration of Artificial Intelligence (AI) tools into the teaching of Basic Science and Technology without manipulating any of the study variables. The population comprised 124 Basic Science and Technology teachers in public junior secondary schools in Daura Local Government Area, Katsina State. A sample of 95 teachers was selected using the Krejcie and Morgan (1970) sample size determination table, after which simple random sampling was employed to select the respondents, ensuring fair representation across the selected schools. Data were collected using a structured questionnaire titled Artificial Intelligence Integration Questionnaire (AI IQ), developed by the researcher based on the objectives of the study and relevant literature. The questionnaire consisted of two sections. Section A elicited respondents' demographic information, while Section B comprised five clusters corresponding to the objectives of the study. Cluster A measured teachers' awareness of Artificial Intelligence tools, Cluster B assessed the availability of Artificial Intelligence instructional tools, Cluster C measured teachers' readiness to utilize AI tools, Cluster D identified the challenges affecting AI integration, while Cluster E assessed teachers' perceived benefits of integrating Artificial Intelligence tools in the teaching of Basic Science and Technology. The questionnaire was structured on a four-point Likert rating scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The instrument was subjected to face and content validation by experts in Science Education and Measurement and Evaluation, who assessed the relevance, clarity, and appropriateness of the questionnaire items. The reliability of the instrument was established using the Cronbach Alpha method, which yielded a reliability coefficient of 0.82, indicating that the instrument possessed satisfactory internal consistency. Data collected were analyzed using mean and standard deviation to answer the research questions, with a criterion mean of 2.50 used for decision-making. The null hypotheses were tested using independent samples t-test and Pearson Product Moment

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Correlation (PPMC) at the 0.05 level of significance using the Statistical Package for the Social Sciences (SPSS) version 25.

Presentation of Results

The results are presented according to the three research questions and the corresponding null hypotheses. Mean and standard deviation were used to answer the research questions, while independent samples *t*-test and Pearson Product Moment Correlation (PPMC) were used to test the null hypotheses at the 0.05 level of significance.

Answer to Research Questions

Research Question One

Table 1: Mean Ratings and Standard Deviations of Teachers' Awareness and Readiness to Integrate Artificial Intelligence Tools

Item No.	Item Description	SA	A	D	SD	$\bar{X}$	SD	Decision
1	AI tools improve instructional delivery in Basic Science and Technology.	38	34	11	7	3.14	0.82	Agreed
2	AI tools simplify difficult scientific concepts for students.	40	33	11	6	3.19	0.79	Agreed
3	Teachers are willing to utilize AI tools during classroom instruction.	40	33	10	7	3.18	0.80	Agreed
Cluster Mean						3.17	0.80	Agreed

Table 1 shows that all the selected items recorded mean scores above the criterion mean of 2.50. The cluster mean of 3.17 (SD = 0.80) indicates that teachers possessed a high level of awareness of Artificial Intelligence tools and were willing to integrate them into the teaching of Basic Science and Technology.

Research Question Two

Table 2: Mean Ratings and Standard Deviations of the Availability of Artificial Intelligence Instructional Tools and Challenges Affecting Their Integration

Item No.	Item Description	SA	A	D	SD	$\bar{X}$	SD	Decision
1	Computers are available for teaching and learning.	18	24	29	19	2.46	0.92	Disagreed
2	Teachers lack adequate training on AI technologies.	41	33	10	6	3.21	0.82	Agreed
3	Poor internet connectivity hinders utilization of AI tools.	44	31	9	6	3.26	0.80	Agreed
Cluster Mean						2.98	0.85	Agreed

Table 2 indicates that although teachers identified inadequate availability of Artificial Intelligence instructional facilities, they also agreed that inadequate training and poor internet connectivity constitute major barriers to AI integration. The cluster mean of 2.98 (SD = 0.85) suggests that infrastructural and capacity related challenges continue to limit the effective integration of AI tools in Basic Science and Technology classrooms.

Research Question Three

Table 3: Mean Ratings and Standard Deviations of Teachers' Perceived Benefits of Integrating Artificial Intelligence Tools

Item No.	Item Description	SA	A	D	SD	$\bar{X}$	SD	Decision
1	AI tools improve instructional delivery.	42	32	10	6	3.22	0.80	Agreed
2	AI promotes personalized learning among students.	44	30	10	6	3.24	0.79	Agreed
3	AI simplifies difficult scientific concepts during instruction.	45	29	10	6	3.26	0.78	Agreed
Cluster Mean						3.24	0.79	Agreed

Table 3 shows that respondents agreed that integrating Artificial Intelligence tools provides significant instructional benefits. The cluster mean of 3.24 (SD = 0.79) indicates that AI has the potential to improve instructional delivery, promote personalized learning, and simplify difficult scientific concepts in Basic Science and Technology.

Hypotheses Testing

Hypothesis One

H₀₁: There is no significant difference in teachers' awareness and readiness to integrate Artificial Intelligence tools based on teaching experience in junior secondary schools in Daura Local Government Area, Katsina State.

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Table 4: Independent Samples *t*-Test on Teachers' Awareness and Readiness Based on Teaching Experience

Teaching Experience	N	Mean	SD	t	df	p-value	Decision
Less Experienced (1–10 years)	42	3.09	0.41				
More Experienced (Above 10 years)	53	3.18	0.39	1.11	93	0.270	Accepted

Table 4 shows that the calculated *t*-value was 1.11 with a corresponding p-value of 0.270, which is greater than the 0.05 level of significance. Therefore, the null hypothesis was accepted. This indicates that there is no significant difference in teachers' awareness and readiness to integrate Artificial Intelligence tools based on teaching experience.

Hypothesis Two

H₀₂: There is no significant difference between the availability of Artificial Intelligence instructional tools and their integration in the teaching of Basic Science and Technology in junior secondary schools in Daura Local Government Area, Katsina State.

Table 5: Pearson Product Moment Correlation between Availability of Artificial Intelligence Instructional Tools and Their Integration

Variables	N	r	p-value	Decision
Availability of AI Instructional Tools	95	0.684	0.000	Rejected
Integration of AI Tools in Teaching	95			

Table 5 indicates that the Pearson Product Moment Correlation coefficient was $r = 0.684$, with a p-value of 0.000, which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. This implies that there is a significant positive relationship between the availability of Artificial Intelligence instructional tools and their integration in the teaching of Basic Science and Technology. As the availability of AI instructional resources improves, teachers are more likely to integrate AI into classroom instruction.

Hypothesis Three

H₀₃: There is no significant difference in teachers' perceptions of the benefits of integrating Artificial Intelligence tools based on gender in junior secondary schools in Daura Local Government Area, Katsina State.

Table 6: Independent Samples *t*-Test on Teachers' Perceptions of the Benefits of Artificial Intelligence Based on Gender

Gender	N	Mean	SD	t	df	p-value	Decision
Male	58	3.25	0.40				
Female	37	3.21	0.42	0.47	93	0.640	Accepted

Table 6 shows that the calculated *t*-value was 0.47, with a corresponding p-value of 0.640, which is greater than the 0.05 level of significance. Therefore, the null hypothesis was accepted. This indicates that there is no significant difference in teachers' perceptions of the benefits of integrating Artificial Intelligence tools based on gender.

Discussion of Findings

The study revealed that Basic Science and Technology teachers in junior secondary schools in Daura Local Government Area demonstrated a high level of awareness and readiness to integrate Artificial Intelligence (AI) tools into classroom instruction. The high cluster mean suggests that teachers recognize the instructional value of AI technologies and are willing to adopt them to improve teaching and learning. This positive disposition may reflect increasing exposure to digital technologies, professional interactions, and the growing global emphasis on AI in education. This finding is consistent with Kamalov et al. (2023), who reported that educators are becoming increasingly aware of the instructional potential of AI and are willing to adopt AI-supported technologies to improve teaching effectiveness. Similarly, UNESCO (2021) emphasized that teachers generally hold positive perceptions of AI and recognize its potential to enhance instructional practices, although successful implementation depends on adequate training and institutional support. The finding, however, contrasts with Olaiya et al. (2025), who reported that many secondary school teachers demonstrated limited awareness and preparedness for integrating Artificial Intelligence into instructional delivery, largely due to inadequate awareness, low self-efficacy, and insufficient preparedness. The implication of this finding is that although teachers are positively disposed towards AI integration, sustained professional development and continuous capacity building programmes are required to translate awareness and readiness into effective classroom practice. The study found that the availability of Artificial Intelligence instructional tools in junior secondary schools in Daura Local Government Area was generally inadequate. Respondents also identified poor internet connectivity, inadequate teacher training, insufficient



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funding, unreliable electricity supply, and limited institutional support as the major challenges affecting AI integration in Basic Science and Technology instruction. This finding agrees with UNESCO (2023), which reported that inadequate digital infrastructure, unstable electricity, limited internet access, and insufficient teacher preparation remain major barriers to the adoption of Artificial Intelligence in education, particularly in developing countries. Likewise, Bali et al. (2024) identified poor technological infrastructure, inadequate funding, and insufficient professional training as significant constraints to AI integration in Nigerian schools. In contrast, Holmes et al. (2019) observed that schools operating in digitally supported learning environments with adequate technological infrastructure experienced more successful implementation of AI-assisted instructional strategies. This contrast suggests that the effectiveness of AI integration depends largely on the availability of infrastructure and institutional investment. The finding indicates that improving infrastructure alone may not guarantee successful AI implementation. Government agencies, school administrators, and other stakeholders should simultaneously address teacher training, funding, internet connectivity, and institutional support to create an enabling environment for AI integration. The study further revealed that teachers perceived Artificial Intelligence tools as beneficial for improving instructional delivery, promoting personalized learning, simplifying complex scientific concepts, enhancing classroom participation, and improving students' academic achievement in Basic Science and Technology. This finding corroborates Holmes et al. (2019), who reported that AI-supported instructional systems enhance learner engagement, facilitate personalized learning experiences, and improve teaching effectiveness. Similarly, Luckin et al. (2016) argued that AI technologies can support adaptive instruction, provide timely feedback, and improve students' learning outcomes by responding to individual learning needs. However, UNESCO (2023) cautioned that the educational benefits of AI may not be fully realized where schools lack appropriate policies, digital infrastructure, ethical guidelines, and adequately trained teachers. This observation suggests that the advantages of AI integration are dependent on supportive implementation conditions rather than the technology alone. Overall, the finding demonstrates that teachers recognize the educational value of Artificial Intelligence and believe that its effective integration could significantly improve the quality of Basic Science and Technology teaching and learning in junior secondary schools.

Conclusion

Based on the findings of this study, it was concluded that Basic Science and Technology teachers in junior secondary schools in Daura Local Government Area, Katsina State, demonstrated a high level of awareness and readiness to integrate Artificial Intelligence (AI) tools into classroom instruction. This indicates that teachers recognize the potential of AI to enhance instructional delivery and are willing to adopt these technologies in teaching when adequate support is available. The study further concluded that the effective integration of AI tools is constrained by inadequate availability of AI instructional facilities, poor internet connectivity, insufficient teacher training, inadequate funding, unreliable electricity supply, and limited institutional support. These challenges continue to hinder the adoption and effective utilization of AI technologies in Basic Science and Technology classrooms. Finally, the study concluded that teachers perceived Artificial Intelligence as a valuable instructional innovation capable of improving instructional delivery, promoting personalized learning, simplifying difficult scientific concepts, enhancing students' classroom participation, and improving academic achievement. Therefore, successful integration of AI in Basic Science and Technology education will require sustained investment in digital infrastructure, teacher capacity development, and supportive educational policies.

Recommendations

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

1. The Katsina State of Education and other relevant educational stakeholders should organize regular training, workshops, and professional development programmes to strengthen teachers' knowledge, skills, and readiness for integrating Artificial Intelligence tools into the teaching of Basic Science and Technology.
2. Government and school authorities should improve the availability of Artificial Intelligence instructional facilities by providing computers, reliable internet connectivity, stable electricity, AI-supported educational software, and other digital learning resources necessary for effective classroom implementation.
3. School administrators, policymakers, and educational stakeholders should develop and implement policies that promote the sustainable integration of Artificial Intelligence into Basic Science and Technology instruction while providing adequate funding, technical support, and monitoring to ensure that AI technologies are effectively utilized to improve teaching quality and students' learning outcomes.



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