



Research Article

## Artificial Intelligence Integration and Personalized Learning Outcomes among Secondary School Students Faskari Local Government Area Katsina State, Nigeria

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Received : February 17, 2026  
Accepted : April 13, 2026

Revised : March 15, 2026  
Available online : May 31, 2026

**How to Cite:** Nuraddeen Adamu Kanon-Haki, Karima Abdulkarim, & Sule Muhammad. (2026). Artificial Intelligence Integration and Personalized Learning Outcomes among Secondary School Students Faskari Local Government Area Katsina State, Nigeria. *INTERDISIPLIN: Journal of Qualitative and Quantitative Research*, 3(3), 196–204. <https://doi.org/10.61166/interdisiplin.v3i3.153>

**Abstract.** This study examined the integration of Artificial Intelligence (AI) and its influence on personalized learning outcomes among secondary school students in Faskari Local Government Area, Katsina State, Nigeria. A quantitative descriptive survey design was adopted, with a sample of 353 students selected through multistage sampling. Data were collected using a validated questionnaire (AIPLQ) with a reliability index of 0.88. Descriptive statistics and t-tests were used for analysis at a 0.05 level of significance. Findings revealed a significant extent of AI integration in teaching and learning ( $M = 3.26, p < .05$ ), indicating that AI tools are actively utilized in classrooms. The study further found that AI-based personalized learning significantly improved students' academic performance, with mean scores increasing from 72.18 to 78.42 ( $p < .05$ ). However, challenges such as

inadequate infrastructure, limited teacher competence, low digital literacy, and ethical concerns were found to significantly hinder effective AI utilization (overall  $M = 3.99$ ,  $p < .05$ ). The study concludes that while AI integration enhances personalized learning and academic outcomes, its effectiveness depends on addressing contextual and systemic barriers. It recommends improved infrastructure, teacher training, digital literacy development, and clear ethical policies to maximize the benefits of AI in secondary education.

**Keywords:** Academic Performance, Artificial Intelligence, Digital Literacy, Personalized Learning, Secondary Education

## INTRODUCTION

The rapid advancement of digital technologies has transformed education, with Artificial Intelligence (AI) emerging as a key tool for enhancing teaching and learning. AI-driven systems enable adaptive, data-driven, and learner-centered environments that cater to individual needs (Jain, Kachhara, Mathur, & Degra, 2024; Taşkın, 2024). Unlike traditional “one-size-fits-all” instruction, AI supports personalized learning by analyzing students’ behaviors, preferences, and performance to deliver tailored content and feedback (Gu, 2024; Zhang, 2024). This personalization is particularly relevant in secondary education, where learners have diverse styles and abilities. However, AI integration improves learning outcomes, including academic performance, engagement, and knowledge retention (Xu, 2024; Hu, 2024). AI tools such as intelligent tutoring systems provide real-time feedback and individualized support, enabling students to learn at their own pace while addressing gaps (Naayini, 2025; Taşkın, 2024). Furthermore, positive effect of AI-assisted personalized learning on cognitive, emotional, and academic development (Hu, 2024).

Despite these benefits, AI adoption in developing regions like Nigeria faces challenges such as inadequate infrastructure, limited digital literacy, and ethical concerns (Naayini, 2025; Lynch, Chen, & Zhao, 2025). Successful integration requires not only technology but also pedagogical strategies and teacher competencies (Lynch et al., 2025; Peng & Li, 2025). Without addressing these issues, the full benefits of AI-driven personalized learning may remain unrealized, particularly in rural and semi-urban areas. Nigeria’s educational reforms aim to improve quality, accessibility, and relevance. AI integration aligns with these goals by offering scalable, learner-centered solutions for overcrowded classrooms and diverse needs (Jain et al., 2024; Xu, 2024). However, there is limited empirical evidence on how AI affects personalized learning outcomes among secondary students in local contexts such as Faskari Local Government Area, Katsina State.

Artificial Intelligence (AI) is gradually transforming teaching and learning in schools, though the level of integration varies widely. Sorensen and Fox (2024) observed that AI tools such as intelligent tutoring systems and adaptive learning platforms are increasingly used in classrooms, yet full integration often depends on school infrastructure and teacher readiness. Similarly, Adedoyin-Awoyele, Adeowu, and Oladejo (2024) reported that AI-based instructional strategies improve student engagement and classroom interaction, but adoption remains inconsistent across

different schools. These findings suggest that while AI is present in educational systems, the extent to which it is fully embedded into teaching practices is influenced by contextual factors, including resources and teacher preparedness. Hu (2024), in a meta-analysis of 31 studies, found that AI-assisted personalized learning significantly improves students' cognitive skills, emotional engagement, and overall academic outcomes. Similarly, Sahito, Sahito, and Imran (2024) reported that students using AI-driven adaptive platforms achieved higher scores in mathematics and reading than peers in conventional classrooms, highlighting the role of personalized instruction in enhancing learning. Wang (2025) further demonstrated that AI tools integrated into student performance monitoring systems allow teachers to identify learning gaps early, enabling timely interventions and improved academic achievement.

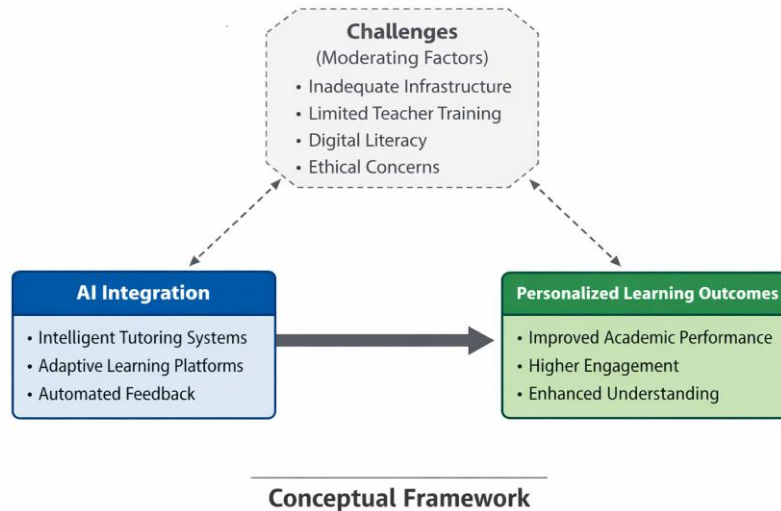
However, challenges remain that can hinder the effective use of AI in education. Garzón, Patiño, and Marulanda (2025) identified barriers such as limited technological infrastructure, insufficient teacher training, and resistance to change, which reduce the practical implementation of AI tools. Ethical concerns, including data privacy and algorithmic bias, also affect the willingness of schools and educators to adopt AI (Lodhi & Lodhi, 2025). Williams et al. (2025) emphasized that without proper professional development and support, teachers may lack confidence in using AI effectively, leading to underutilization even where technology is available. These findings collectively underline the need to examine not only how AI is integrated into classrooms but also its impact on student learning and the contextual challenges affecting its effective use, particularly in secondary schools in areas such as Faskari Local Government Area. However, there is limited empirical evidence on how AI affects personalized learning outcomes among secondary students in local contexts such as Faskari Local Government Area, Katsina State.

This study, therefore, seeks to examine the influence of AI integration on personalized learning outcomes among secondary school students in Faskari Local Government Area, contributing context-specific insights to inform policy, practice, and future research in Nigeria and similar developing settings.

### **Conceptual Framework**

The study conceptualizes that Artificial Intelligence (AI) integration in secondary school teaching, through tools such as intelligent tutoring systems, adaptive learning platforms, and automated feedback mechanisms, can significantly enhance personalized learning outcomes. These outcomes include improved academic performance, higher engagement, and better understanding of subject content. The framework recognizes that the effectiveness of AI is influenced by moderating factors such as technological infrastructure, teacher competence, digital literacy, and ethical concerns including data privacy and equity of access. When AI is effectively integrated, teachers can tailor instruction to individual student needs, provide timely feedback, and monitor progress continuously, which fosters a more learner-centered environment. Conversely, contextual challenges can limit the adoption and impact of AI, reducing the potential benefits of personalized learning. This conceptual framework provides a structured guide for examining the relationship between AI integration, personalized learning outcomes, and

implementation challenges in secondary schools within Faskari Local Government Area, highlighting both the potential and the limitations of AI in improving educational practices in local contexts.



The diagram shows that AI integration in teaching directly impacts personalized learning outcomes like academic performance and student engagement. Challenges such as infrastructure, teacher competence, and ethical concerns can influence how effectively AI improves these outcomes.

### Research Objectives

1. To examine the extent of Artificial Intelligence (AI) integration in teaching and learning among secondary school students in Faskari Local Government Area.
2. To determine the influence of AI-based personalized learning on students' academic performance.
3. To assess the challenges affecting the effective use of AI for personalized learning among secondary school students.

### Research Questions

1. What is the extent of Artificial Intelligence integration in teaching and learning among secondary school students in Faskari Local Government Area?
2. How does AI-based personalized learning influence students' academic performance?
3. What are the challenges affecting the effective use of AI for personalized learning among secondary school students?

### Research Hypotheses

1.  $H_{01}$ : There is no significant extent of Artificial Intelligence integration in teaching and learning among secondary school students in Faskari Local Government Area.

2.  $H_{02}$ : AI-based personalized learning has no significant influence on students' academic performance.
3.  $H_{03}$ : There are no significant challenges affecting the effective use of AI for personalized learning among secondary school students.

### Research Methodology

The study adopted a quantitative approach using a descriptive survey design to investigate Artificial Intelligence (AI) integration and its influence on personalized learning outcomes among secondary school students in Faskari Local Government Area of Katsina State, Nigeria. The population comprised secondary school students, from which a sample of 353 respondents was selected through a multistage sampling technique involving stratification and simple random sampling to ensure adequate representation. Data were collected using a structured questionnaire titled Artificial Intelligence Integration and Personalized Learning Questionnaire (AIIPLQ), designed to measure the extent of AI integration, its influence on academic performance, and the challenges affecting its effective use. The instrument utilized a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). Validity was ensured through expert review, while reliability was established using Cronbach's alpha, yielding a coefficient of 0.88, indicating high internal consistency.

The questionnaire was administered directly to respondents with the support of trained research assistants, ensuring a high response rate and proper understanding of items. Ethical considerations such as voluntary participation, anonymity, and confidentiality were maintained throughout the study. Data collected were analyzed using both descriptive and inferential statistics. Mean and standard deviation were used to answer research questions, while hypotheses were tested at a 0.05 level of significance using one-sample t-test to assess the extent of AI integration and challenges, and paired sample t-test to examine the influence of AI-based personalized learning on students' academic performance. Results were presented in tables and interpreted accordingly.

### Results

**Table 1:** One-Sample t-test for Extent of AI Integration ( $H_{03}$ )  
(Test value = 2.50 – neutral midpoint)

Variables	N	Mean	SD	t-value	df	Sig. (2-tailed)	Decision
AI tools are used in teaching and learning	353	3.26	0.82	4.75	352	0.000	Reject $H_{03}$

The result of the one-sample t-test indicated that the mean score for the use of AI tools in teaching and learning ( $M = 3.26$ ,  $SD = 0.82$ ) was significantly higher than the neutral midpoint of 2.50,  $t(352) = 4.75$ ,  $p < .05$ . This implies that there is a statistically significant extent of AI integration in teaching and learning among secondary school students. Therefore, the null hypothesis ( $H_{01}$ ) was rejected.

**Table 2:** Paired Samples t-test on Integration of Counseling Approaches and Psychological Well-being ( $H_{02}$ )

Variables	N	Mean	SD	t-value	df	Sig. (2-tailed)	Decision
Academic performance before AI integration	353	72.18	10.12	6.21	352	0.000	Reject $H_{02}$
Academic performance after AI integration	353	78.42	9.65				

The results of the paired samples t-test revealed that students' academic performance after AI integration ( $M = 78.42$ ,  $SD = 9.65$ ) was higher than before AI integration ( $M = 72.18$ ,  $SD = 10.12$ ), and this difference was statistically significant,  $t(352) = 6.21$ ,  $p < .05$ . This indicates that AI-based personalized learning significantly improved students' academic performance. Therefore, the null hypothesis ( $H_{02}$ ) was rejected.

**Table 3:** One-Sample t-test on Challenges and Opportunities in Integration ( $H_{03}$ ) (Test value = 2.50 – neutral midpoint)

Variables	N	Mean	SD	t-value	df	Sig. (2-tailed)	Decision
Inadequate infrastructure	353	4.12	0.78	14.98	352	0.000	Reject $H_{03}$
Limited teacher competence	353	4.05	0.81	13.50	352	0.000	Reject $H_{03}$
Students' digital literacy	353	3.92	0.85	11.72	352	0.000	Reject $H_{03}$
Ethical concern (data privacy, bias)	353	3.88	0.79	11.55	352	0.000	Reject $H_{03}$
<b>Total</b>	<b>353</b>	<b>3.99</b>	<b>0.81</b>	<b>13.10</b>	<b>352</b>	<b>0.000</b>	<b>Reject <math>H_{03}</math></b>

The results of the one-sample t-test showed that all identified challenges had mean scores significantly higher than the neutral midpoint of 2.50, indicating their strong influence on the integration of AI. Specifically, inadequate infrastructure ( $M = 4.12$ ,  $SD = 0.78$ ,  $t(352) = 14.98$ ,  $p < .05$ ), limited teacher competence ( $M = 4.05$ ,  $SD = 0.81$ ,  $t(352) = 13.50$ ,  $p < .05$ ), students' digital literacy ( $M = 3.92$ ,  $SD = 0.85$ ,  $t(352) = 11.72$ ,  $p < .05$ ), and ethical concerns ( $M = 3.88$ ,  $SD = 0.79$ ,  $t(352) = 11.55$ ,  $p < .05$ ) were all statistically significant. The overall challenges score ( $M = 3.99$ ,  $SD = 0.81$ ,  $t(352) = 13.10$ ,  $p < .05$ ) further confirms that challenges significantly affect the effective use of AI for personalized learning. Therefore, the null hypothesis ( $H_{03}$ ) was rejected.

## Discussion of Findings

The finding for the first hypothesis revealed that there is a significant extent of Artificial Intelligence (AI) integration in teaching and learning among secondary school students, as the null hypothesis was rejected. This implies that AI tools are being meaningfully utilized in instructional processes. This finding aligns with Sorensen and Fox (2024), who reported that AI technologies such as adaptive learning systems and intelligent tutoring platforms are increasingly being incorporated into classroom practices to enhance instructional delivery. Similarly, Adedoyin-Awoyele et al. (2024) found that AI-based instructional strategies improve classroom interaction and engagement, indicating that AI integration is gradually becoming a key component of modern educational practices. The implication is that even in developing contexts, there is a growing adoption of AI tools, although the level of integration may still vary across schools.

The result of the second hypothesis showed that AI-based personalized learning significantly improves students' academic performance, leading to the rejection of the null hypothesis. This suggests that students benefit academically when exposed to AI-driven personalized learning environments. This finding is consistent with Hu (2024), whose meta-analysis revealed that AI-assisted personalized learning positively influences students' cognitive development and academic achievement. In the same vein, Sahito, Sahito, and Imran (2024) found that students using AI-powered adaptive learning platforms performed better academically than those in traditional learning settings due to tailored instruction and real-time feedback. Wang (2025) also supported this outcome by demonstrating that AI-enabled performance monitoring systems help teachers identify learning gaps and provide timely interventions, thereby improving students' academic outcomes. This underscores the effectiveness of AI in enhancing personalized learning and academic success.

The findings for the third hypothesis indicated that challenges significantly affect the effective use of AI for personalized learning, as the null hypothesis was rejected. High mean scores on factors such as inadequate infrastructure, limited teacher competence, low digital literacy, and ethical concerns confirm that these barriers hinder the optimal use of AI in education. This finding agrees with Garzón, Patiño, and Marulanda (2025), who identified infrastructural limitations and lack of teacher preparedness as major barriers to AI adoption in schools. Similarly, Williams et al. (2025) emphasized that insufficient training and low confidence among teachers reduce their ability to effectively integrate AI tools into teaching. Furthermore, Lodhi and Lodhi (2025) highlighted ethical concerns such as data privacy and algorithmic bias as critical issues that affect trust and acceptance of AI technologies in education. These findings suggest that while AI has strong potential to enhance learning, its effectiveness is largely dependent on addressing these contextual and systemic challenges.

## CONCLUSION

This study examined the extent of Artificial Intelligence (AI) integration and its influence on personalized learning outcomes among secondary school students in Faskari Local Government Area, Katsina State. The findings revealed that AI is significantly integrated into teaching and learning, and its application through personalized learning approaches has a positive and significant effect on students' academic performance. This indicates that AI-driven instructional tools enhance student engagement, understanding, and overall learning outcomes. However, the study also established that several challenges, including inadequate infrastructure, limited teacher competence, low digital literacy, and ethical concerns, significantly hinder the effective use of AI in education. These challenges limit the full realization of the benefits of AI integration in secondary schools. Therefore, while AI presents a valuable opportunity for improving educational practices and outcomes, its effectiveness depends largely on the availability of resources, teacher preparedness, and supportive policies.

### Recommendations

1. Government and educational stakeholders should invest in adequate technological infrastructure, including reliable internet access and AI-supported learning tools, to enhance effective AI integration in schools.
2. Regular training and professional development programs should be organized for teachers to improve their competence and confidence in using AI-based instructional technologies.
3. Schools should promote digital literacy among students to enable them effectively engage with AI-driven personalized learning platforms.
4. Clear policies and ethical guidelines should be established to address issues of data privacy, security, and fairness in the use of AI in education.
5. Educational authorities should encourage continuous research and monitoring of AI implementation to ensure its effectiveness and sustainability in improving students' academic performance.

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