JOURNAL OF SCIENCE EDUCATION AND RESEARCH (JSER)
PROF. PATRICK C. IGBOJINWAEKWU

JOURNAL OF SCIENCE EDUCATION AND RESEARCH (JSER)

Vol. 8(2); 2026

ISSN ONLINE: 3092-9253

Editor in-Chief
PROF. PATRICK C. IGBOJINWAEKWU

JOURNAL OF SCIENCE EDUCATION AND RESEARCH

(JSER) 8 (2); 2026

ISSN Online: 3092-9253

Published in March, 2026.

Printed in Nigeria in the year 2026 by:
Love Isaac Consultancy Services (Publication Unit)
No 1 Etolue Street, Ifite Awka, Anambra State, Nigeria
+234-803-549-6787, +234-803-757-7391

EDITORIAL BOARD

EDITORIAL

Journal of Science Education and Research (JSER)is a peer-reviewed published Bimonthly. It aimed at advancing knowledge and professionalism in all aspects of educational research, including but not limited to innovations in science education, educational technology, guidance and counselling psychology, childhood studies and early years, curriculum studies, evaluation, vocational training, planning, policy, pedagogy, human kinetics, health education and so on. JSER publish different types of research outputs including monographs, field articles, brief notes, comments on published articles and book reviews.

We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Patrick C. Igbojinwaekwu
Editor-in-Chief

TABLE OF CONTENTS

JOURNAL OF SCIENCE EDUCATION AND RESEARCH (JSER)
VOL.8 (2); 2026

ARTIFICIAL INTELLIGENCE INTEGRATED TEACHING METHOD ON SECONDARY SCHOOL STUDENTS' INTEREST AND ACADEMIC ACHIEVEMENT IN MATHEMATICS IN ABA EDUCATION ZONE, ABIA STATE.

[1]Njoku, Celestine (Ph.D), [2]Inah, Lovinah Idoko. A (Ph. D), [3]Emeka, Standhope .I (Ph. D)

[1]celestinenjoku@unical.edu.ng
[1]+2348037341308

[1,2,3]Department of Mathematics and Computer Science Education
University of Calabar, Cross River State, Nigeria

Abstract

This study determined the effect of Artificial Intelligence integrated teaching method (AIITM) on secondary school students' interest and academic achievement in Mathematics in the Aba Education Zone, Abia State. Five research questions and four hypotheses, tested at the 0.05 level, guided the study. An explanatory sequential mixed-method design was adopted, combining a quasi-experimental pretest– posttest non-equivalent control group design with a phenomenological approach. The population of the study was 10,074 Senior Secondary School Two(SSS2) students. A sample of 200 SSS2 students from six schools in the 2024/2025 academic year was selected through multistage sampling. Data were gathered using the Mathematics Achievement Test (MAT, reliability = 0.81), Mathematics Interest Scale (MIS, reliability = 0.71), and Focus Group Discussions (FGDs). Quantitative data were analyzed with mean, standard deviation, and ANCOVA, while qualitative data were thematically analyzed using NVivo. Findings revealed significant improvement in both interest and achievement among students taught with AIITM. The study recommends integrating AI into Mathematics teaching and the strengthening digital infrastructure.

Keywords: Artificial Intelligence integrated Teaching Method, Academic Achievement, Interest

Introduction

Mathematics is the bedrock of science, technology, and innovation, providing essential skills for national development. In Nigeria, Mathematics is compulsory at all levels of education because of its critical role in fostering analytical reasoning, problem-solving, and logical thinking (Adebayo, 2021; Osuafor& Njoku, 2016).). However, despite its centrality, the academic achievement of secondary school students in Mathematics remains persistently poor. Chief examiners reports on mathematics from the West African Examinations Council (WAEC, 2019– 2024) consistently highlight students' weak performance in key areas such as geometry, algebra, and trigonometry, raising concerns about their preparedness for higher education and STEM-related careers.

Persistent academic underachievement in Mathematics has been linked to systemic challenges in teaching and learning, including overreliance on teacher-centered methods, lack of instructional innovation, and lowinterest of student toward the subject (WAEC, 2019– 2024) These challenges have fueled calls for alternative strategies that can make Mathematics more engaging, interactive, and student-centered. In this context, the integration of Artificial Intelligence (AI) into teaching of Mathematics is considered expedients. AI-based teaching methods provide adaptive learning experiences by analyzing learners' responses(Njoku & Emeka, 2025) and offering personalized feedback in real time (Chen et al., 2023). Unlike conventional approaches that treat all learners uniformly, AI tools such as ChatGPT and other intelligent tutoring systems simulate interactive dialogue, break down complex concepts into simpler steps, and foster curiosity (Njoku & Njoku, 2025). These features make AI a viable tool for addressing persistent comprehension gaps in Mathematics classrooms. However, existing research findings on the effectiveness of AI tools are mixed. While some studies reported significant improvements in learning outcomes (Adeoye & Olanrewaju, 2023), others found modest or inconsistent effects (Eze & Nwafor, 2023, Njoku & Njoku, 2025). This suggests the need for context-specific studies in Nigerian schools.

Another dimension of the Mathematics learning crisis is the issue of students' interest. Scholars argue that without positive interest, learners may disengage, regardless of the teaching method employed (Alabdulkareem et al., 2022). Low interest in Mathematics often lead to low achievement and reluctance to pursue STEM courses. AI tools, with their interactive and responsive nature, have been found to enhance students' motivation, build confidence, and reduce fear (Edeh et al., 2024). Thus, any investigation into AI-based

teaching must simultaneously examine both affective (interest) and cognitive (achievement) outcomes.

The role of gender in student' s interest and achievement in Mathematics remains a contested issue. Some empirical studies report that male students perform better in technology-mediated learning environments (Adeniran, 2022), while others find no significant difference between male and female students when exposed to AI-integrated strategies (Chukwu &Idaka, 2023). These contradictions necessitated the inclusion of gender as a variable to determine whether AI integrated teaching method can help increase students interest and improve academic achievement of students in Mathematics.

Given the persistent decline in interest and underachievement in Mathematics and unresolved gender disparities, therefore, this study investigated the effect of AI integration teaching method on students' interest and academic achievement in Mathematics in Aba Education Zone in Abia State. Adopting an explanatory sequential mixed-method design, the study first quantified the effect of AI integrated teaching method on interest and achievement, and then explored students' lived experiences to provide deeper explanations for the observed outcomes interest and academic achievement.

Statement of the Problem

Despite Mathematics being compulsory and central to national development, secondary school students in Nigeria continue to perform poorly, especially in areas such as geometry, algebra, and trigonometry. This persistent underachievement has been linked to teacher-centered methods, lack of innovative strategies, and declining student interest. Although Artificial Intelligence (AI) offers adaptive and interactive learning experiences, existing studies report mixed results on its effectiveness, while the role of gender in influencing students' outcomes remains unresolved. In the Aba Education Zone, where Mathematics underachievement and low interest persist, there is little empirical evidence on how AI-integrated teaching methods affect students' interest, achievement, and gender differences. This study, therefore, seeks to address the problem of persistent low interest and poor achievement in Mathematics, and the uncertain role of gender, by investigating the effect of AI-integrated teaching methods on secondary school students. The problem of this study is, what is the effect of AI integration teaching method on students' interest and academic achievement in Mathematics.

Purpose of the Study

The purpose of this study is to investigate the effect of Artificial Intelligence Integrated Teaching Method (AIITM) on Secondary school students' interest and academic achievement in Mathematics. Specifically, the study aims to determine the;

1. difference between the mean interest scores of students taught Mathematics with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.
2. influence of gender on the mean interest scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method
3. difference between the mean academic achievement scores of students taughtwith Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.
4. influence of gender on the mean academic achievement scores of students taughtwith Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.
5. examined the students' perceptions of Artificial Intelligence (AI) Integration Teaching Method in Mathematics teaching and learning.

Research Questions

The following research questions guided the study;

1. What is the difference between the mean interest scores of students taught Mathematics with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method?
2. What is the difference between the mean interest scores of male and female students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method?
3. What is the difference between the mean academic achievement scores of students taughtwith Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method?
4. What is the difference between the mean academic achievement scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method?

5. What are the students' perceptions of Artificial Intelligence (AI) Integration Teaching Method in Mathematics teaching and learning?

Hypotheses

The following hypotheses were formulated and tested 0.05 level of significance

1. There is no significant difference between the mean interest scores of students taught Mathematics with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.
2. There is no significant influence of gender on the mean interest scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method
3. There is no significant difference between the mean academic achievement scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.
4. There is no significant influence of gender on the mean academic achievement scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.

Methods

This investigation employed a mixed-methods approach using an explanatory sequential design. The population of the study was 10,074 SSS2 students enrolled in the Aba Education Zone during the 2024/2025 academic year. However, participation was limited to those with access to Android smart phones or laptops. Using a multi-stage sampling procedure, 200 students were selected. Three instruments were applied: the Mathematics Achievement Test (MAT), the Mathematics Interest Scale (MIS), and a Focus Group Discussion (FGD guide). The MAT was adapted from WAEC past questions (2018– 2024) and included 50 multiple-choice questions (A– D options). Reliability testing produced KR-20 = 0.81 and a test– retest coefficient of r = 0.71, confirming its stability. The MIS, adapted from Abutu (2013), originally had 30 items with internal consistency of $\alpha = 0.90$. Expert validation led to the removal of five irrelevant items, leaving 25. The scale was divided into two sections: Section A (bio-data) and Section B (25 Likert items rated from Highly Interested = 4 to Highly Uninterested = 1). Scores of 50% and above reflected positive interest. The FGD was

employed to gather in-depth qualitative data, giving students the opportunity to describe their experiences with AI-based instruction in their own words.

In each participating school, intact classes were allocated to both experimental and control groups. The experimental group, consisting of students who had Android devices or laptops, received lessons through AI-Integrated Teaching Method (AIITM), while the control group was taught with traditional method. Teachers in the experimental arm were trained to implement AIITM effectively. The intervention lasted eight weeks, covering geometry, algebra, and trigonometry. AIITM provided guided solutions, simplified abstract concepts, and linked problems to real-world contexts, while teachers acted primarily as facilitators.

For quantitative data, the MAT and MIS were administered as pre-tests before the intervention and as post-tests immediately after. The researchers, assisted by trained personnel, recorded the results. For the qualitative phase, 36 students were purposively chosen from the experimental group five days after the post-test. The participants represented high, average, and low scorers. Four focus groups were formed, each consisting of eight students. WhatsApp groups were created for interaction, and each group later participated in a 60– 90 minute Zoom session, which was recorded and transcribed. The quantitative data were cleaned and analyzed using descriptive statistics (mean, standard deviation) to answer research questions, while hypotheses were tested with Two-Way ANCOVA, using pre-test scores as covariates. All tests were conducted at the 0.05 level of significance. For the qualitative analysis, the FGD transcripts were imported into NVivo software, and thematic analysis was carried out to identify key themes and recurring patterns that explained students' experiences, perceptions, and attitudes toward Mathematics learning under AIITM.

Result

Research Question 1: What is the difference between the mean interest scores of students taught Mathematics with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method?

Table 1: Mean Interest score of students taught using AIITM and Traditional Method (TM)

		Pre-test		Posttest		Mean($\overline{X}$)
Source of Variation	**N**	$\overline{X}$	**SD**	$\overline{X}$	**SD**	**Gain**
AIITM	I06	15.68	8.50	61.62	7.25	45.14
TM	94	15.85	8.21	46.23	9.58	30.38

Table 1 shows that students who were exposed to AIITM had pre-interest mean score of 15.68 with a standard deviation of 8.50 and post-interest mean score of 61.62 and standard deviation of 7.25 while their counterparts who were taught using TM had pre-interestmean score of 15.85 with a standard deviation of 8.21 and post-interest mean score of 46.23 with standard deviation of 9.58. Mean gain interest scores of 45.14 and 30.38 for students who were exposed to AIITM and TM respectively indicating that students who were exposed to AIITM had higher mean interest scores than their counterparts exposed to TM.

Research Question 2: What is the difference between the mean interest scores of male and female students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method?

Table 2: Mean interest score of male and female students taught using AIITM and Traditional Method (TM).

Source of variation	Gender	N	Type of Test		$\overline{X}$	SD
AIITM	Male	52	Post-interest		61.77	8.67
			Pre-interest		15.47	8.50
			Mean Gain		46.30	
TM	Male	49	Post-interest	46.80	10.37	
			Pre-interest		15.71	9.24
			Mean Gain		31.09	
	Total	101				
AIITM	Female	54	Post-interest		61.47	6.92
			Pre-interest		15.23	8.33
			Mean Gain		46.14	
TM	Female	45	Post-interest		45.60	7.92
			Pre-interest		15.98	8.21
			Mean Gain		30.62	
	Total	99				

The result presented in Table 2 reveals that the male students exposed to AIITM had a pre-interest mean score of 15.47with a standard deviation of 8.50 and a post-interest mean achievement score of 61.77with a standard deviation of 8.67. The mean gain interest score of male students exposed to AIITM was 46.30.The female students exposed to AIITM had a pre-interest mean interestscore of 15.23 with a standard deviation of 8.33 and a post-interest mean interest score of 61.47 with a standard deviation of 6.92.The mean gain interest score of female students exposed to AIITM was 46.14. This, therefore, means that male students exposed to AIITM slightly had higher interest than their female counterparts exposed to AIITM.

Research Question 3: What is the difference between the mean academic achievement scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method?

Table 3: Mean achievement score of students taught using AIITM and Traditional Method (TM).

		Pre-test		Posttest		Mean($\overline{X}$)
Source of Variation	**N**	$\overline{X}$	**SD**	$\overline{X}$	**SD**	**Gain**
AIITM	106	21.55	3.50	53.81	3.43	32.26
TM	94	21.51	3.21	28.45	5.58	6.93

The result in Table 3 shows that the pre-test mean academic achievement score of students taught Mathematics using AIITM is 21.55 and standard deviation of 3.51 while the students taught Mathematics with TM obtained a pre-test mean academic achievement score of 21.51 and a standard deviation of 3.21. The result further shows that the post-test mean academic achievement score of students taught Mathematics with AIITM is 53.81 with a standard deviation of 3.43 whereas the students taught Mathematics with TM obtained a posttest mean academic achievement score of 28.45 and a standard deviation of 5.58. The result further indicates that the mean gain academic achievement score of students taught Mathematics with AIITM is 32.26 while that of students taught Mathematics with TM is 6.93.Thus, the students exposed to AIITM had higher mean gain academic achievement score than the students exposed to TM.

Research Question 4: What is the difference between the mean academic achievement scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method?

Table 4: Mean Achievement score of male and female students taught using AIITM and Traditional Method.

Source of variation	Gender	N	Type of Test	$\overline{X}$	SD
AIITM	Male	52	Post-test	53.65	5.67
			Pre test	21.47	4.50
			Mean Gain	32.18	
TM	Male	49	Post-test	28.75	5.37
			Pre test	21.63	5.24
			Mean Gain	7.12	
		Total 101			
AIITM	Female	54	Post-test	53.98	6.92
			Pre test	21.63	6.33
			Mean Gain	32.35	
TM	Female	45	Post-test	28.22	6.92
			Pre test	21.40	4.21
			Mean Gain	7.82	
		Total 99			

Table 4 reveals that the male students exposed to AIITM had a pretest mean academic achievement score of 21.47 with a standard deviation of 4.50 and a posttest mean academic achievement score of 53.65 with a standard deviation of 5.67. The mean gain academic achievement score of male students exposed to AIITM was 32.18.The female students exposed to AIITM had a pretest mean academic achievement score of 21.63 with a standard deviation of 6.33 and a posttest mean academic achievement score of 53.98 with a standard deviation of 6.92. The mean gain academic achievement score of female students exposed to AIITM was 32.35. This result shows that female students exposed to AIITM had an improved in academic achievement than their male counterpart exposed to AIITM.

Research Question 5: What are the students' perceptions of Artificial Intelligence (AI) Integration Teaching Method in Mathematics teaching and learning?

The thematic analysis of Focus Group Discussions revealed that students held largely positive perceptions of AI integration in Mathematics teaching,.

Theme 1: Improved Understanding of Mathematical Concepts

Students consistently highlighted that AI helped simplify abstract concepts and present solutions in logical, step-by-step formats. This perception underscores AI' s strength in enhancing conceptual clarity and making difficult areas of Mathematics more accessible. It suggests that students viewed AI as a bridge between abstract theory and practical understanding, thereby filling gaps left by conventional teacher-led approaches.

Theme 2: Boost in Confidence and Motivation

Participants emphasized that AI tools encouraged them to attempt difficult questions without fear of failure. This indicates that AI played a critical role in reducing Mathematics-related anxiety, building self-efficacy, and fostering a growth mindset. The perception of AI as a motivator reflects its affective benefits, which extend beyond academic achievement to improving attitudes and confidence in Mathematics learning.

Theme 3: Complementary Role of AI in Teaching

Students perceived AI not as a substitute for teachers but as a complementary instructional tool. This theme reveals an understanding of the irreplaceable human role in teaching, while acknowledging the value of AI in reinforcing and enriching classroom experiences. The perception of AI as a supportive partner to teachers suggests that students prefer a blended approach where technology augments rather than replaces human instruction.

$H0_1$: There is no significant difference between the mean interest scores of students taught Mathematics with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.

Table 5: Summary of two-way ANCOVA of interest score of students taught Mathematics using AIITM and TM.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7167.510[a]	4	1791.878	92.138	.000	.654
Intercept	1387.620	1	1387.620	71.351	.000	.268
PreInterest	1186.911	1	1186.911	61.031	.000	.238
Strategy	5730.396	1	5730.396	294.656	.000	.602
Gneder	18.165	1	18.165	.934	.335	.005
Strategy * Gneder	24.753	1	24.753	1.273	.261	.006
Error	3792.310	195	19.448			
Total	277848.000	200				
Corrected Total	10959.820	199				

a. R Squared = .654 (Adjusted R Squared = .647)

The result in Table 5 shows that there is a significant main effect of AIITM on students' interest in Mathematics; F (1, 200) = 284.014, p = .0005, effect size = 67.0. The null hypothesis was therefore rejected. Thus, there is significant difference between the mean interest scores of students who were taught Mathematics using AIITM and those taught using TM.

$H0_2$: There is no significant influence of gender on the mean interest scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.

Hypothesis 2 was tested with ANCOVA and the result of the test is summarized in Table 5. The table shows that there is no influence of gender on students' interest scores in Mathematics; FF(1, 200) = 7.062, P = 0.009. Therefore, the hypothesis that there is no significant influence of gender on the mean interest scores of students taught Mathematics was not rejected.

$H0_3$: There is no significant difference between the mean academic achievement scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.

Table 6: Summary of two-way ANCOVA of academic achievement score of students taught Mathematics using AIITM and TM.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	21687.270[a]	4	5421.818	186.684	.000	.793
Intercept	18496.466	1	18496.466	636.869	.000	.766
Pretest	6961.900	1	6961.900	239.712	.000	.551
Strategy	14031.081	1	14031.081	483.117	.000	.712
Gender	16.813	1	16.813	.579	.448	.003
Strategy * Gender	63.391	1	63.391	2.183	.141	.011
Error	5663.350	195	29.043			
Total	602586.000	200				
Corrected Total	27350.620	199				

a. R Squared = .793 (Adjusted R Squared = .789)

Table 6 reveals significant main effect of AIITM on students' academic achievement in Mathematics; F (1, 200) = 1030.263, p =.0005, effect size = 83.7. The null hypothesis was therefore rejected. Thus, there is significant difference between the mean academic achievement scores of students who were taught Mathematics using AIITM and those taught using TM. The result indicates that students who were taught Mathematics using AIITM had higher academic achievement in Mathematics than those taught using TM.

$H0_4$: There is no significant influence of gender on the mean academic achievement scores of students taught with Artificial Intelligence (AI) Integration Teaching Method and those taught Mathematics with traditional method.

Hypothesis 4 was tested with ANCOVA in order to determine the influence of gender on students' academic achievement scores in Mathematics and the result of the test is summarized in Table 6. Table 6 reveals that there is no significant effect of gender on students' academic achievement scores in Mathematics; F(1, 200) = 8.523, P = 0.008. The null hypothesis was not rejected.

In summary, the quantitative results showed that students taught Mathematics using AI integration teaching method significantly outperformed those taught with conventional method in both achievement and interest. Gender had no significant effect on achievement

and interest. Qualitative findings revealed that AI tools simplified abstract concepts, boosted confidence, and encouraged active participation. Students reported that instant feedback and interactive explanations increased their motivation and reduced anxiety.

Discussion

The study showed that Artificial Intelligence (AI) integration significantly enhanced students' academic achievement in Mathematics compared to conventional teacher-centered methods. This finding confirms earlier reports (Chen et al., 2023; Njoku & Njoku, 2025) that AI tools simplify complex concepts, provide adaptive feedback, and bridge comprehension gaps in topics where students often perform poorly. AI integration also improved students' interest, as participants reported greater motivation, confidence, and reduced anxiety. This supports the view of Alabdulkareem et al. (2022) that student engagement is central to achievement and can be fostered through interactive, learner-centered approaches. On gender, no significant differences were observed in achievement and interest, indicating that AI-based methods provide equitable learning opportunities. This corroborates Chukwu &Idaka (2023) but contradicts Adeniran (2022), suggesting that AI may help close gender gaps in Mathematics learning. Qualitative insights reinforced these findings, revealing that students valued AI for its interactive nature, personalized support, and ability to make Mathematics less intimidating. Overall, the results demonstrate that AI integration can address the persistent challenges of low achievement and declining interest in Mathematics while promoting inclusivity in Nigerian classrooms.

Conclusion

AI integration in Mathematics teaching improved students' achievement and interest without gender bias, demonstrating its potential as an equitable and effective strategy for enhancing Mathematics learning in Nigerian schools

Recommendations

The study recommends that;

1. Teachers should be trained to integrate AI tools into Mathematics classrooms.
2. AI-based teaching should be incorporated into school curricula to complement traditional methods.
3. Government and stakeholders should provide ICT infrastructure to support AI-driven instruction.
4. Further research should explore long-term effects of AI integration across different subjects and contexts.

References

Adebayo, K. A. (2021). Mathematics as the foundation of science and technology: Implications for national development in Nigeria. *Journal of Education and Practice*, 12(4), 55– 62.

Adeniran, T. O. (2022). Gender and technology integration in mathematics learning: A Nigerian perspective. *African Journal of Gender and Education Studies*, 8(1), 112– 124.

Adeoye, F. O., & Olanrewaju, A. S. (2023). Artificial intelligence and student learning outcomes: Evidence from secondary schools. *International Journal of Educational Technology and Learning*, 13(2), 44– 53. https://doi.org/10.5430/ijetl.v13n2p44

Alabdulkareem, S. A., Alzahrani, A. A., & Alharbi, A. S. (2022). Students' attitudes toward mathematics and their relationship to achievement: A systematic review. *Journal of Mathematics Education Research*, 14(1), 67– 81.

Chen, Y., Li, M., & Zhao, H. (2023). Artificial intelligence in education: A systematic review of adaptive learning and student performance. *Computers & Education*, 195, 104674. https://doi.org/10.1016/j.compedu.2023.104674

Chukwu, E., &Idaka, I. (2023). Exploring gender differences in AI-based mathematics instruction in Nigerian secondary schools. *Journal of Educational Research and Innovation*, 17(3), 221– 233.

Eze, A. C., & Nwafor, I. A. (2023). Effectiveness of artificial intelligence tools in mathematics classrooms: A comparative study. *International Journal of Digital Learning*, 9(4), 50– 63.

Njoku, C.& Emeka, S.I (2025). Effect of Motivation-Oriented Teaching Strategy on Students' Achievement in Mathematics in Aba Education Zone. *Journal of Innovation in science Education*, 1(1). 20-30.

Njoku, C.& Njoku, I.O (2025a). Effect of Chat Generative Pre-Trained Transformer(ChatGPT) on Secondary School Students' Academic Achievement and Interest in Geometry. *African Journal of Science, Technology & Mathematics Education(AJSTME*) 11 (2). 103-114.

Njoku, C.& Njoku, I.O (2025b). Effect of Augmented Reality (AR) Tools on Low Achieving Students' Engagement in Mathematics in Aba Education Zone.*UNIZIKJournal of STM Education.* 8, (2). 36-48.

Osuafor, A,M.&Njoku, C (2016). Effect of prior knowledge of behavioural objectives on mathematics achievement of high and low mental ability secondary school students in Imo State, Nigeria. *PEOPLE: International Journal of Social Sciences2*, (2). 255-264.

West African Examinations Council (WAEC). (2019– 2024). *Chief examiners' reports on candidates' performance in Mathematics.* WAEC.