Leveraging Artificial Intelligence to Enhance Mathematics Learning: Bridging Skill Gaps and Fostering Economic Growth in Nigeria

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ABSTRACT

Artificial Intelligence (AI) has emerged as a transformative technology in mathematics education in Nigeria. Studies have shown that AI tools can improve student performance and learning outcomes, but implementation requires addressing teacher preparedness and curriculum integration. This research surveyed 520 respondents from secondary and tertiary institutions in Ondo, representing Nigeria's ethnic groups. The results show that AI integration enhances mathematics performance compared with traditional methods, effectively addressing individual learning needs. Success depends on digital infrastructure, teacher competency, and funding. This study demonstrates AI's potential of AI to develop workforce readiness for Nigeria's economic growth. Recommendations include improving the infrastructure, building teacher capacity, developing local solutions, and establishing supportive policies while addressing access challenges.

Keywords: Artificial Intelligence, Mathematics Education, Personalized Learning, Digital infrastructure, Economic Growth

INTRODUCTION

Mathematics education is crucial for developing critical thinking, problem solving, and analytical skills that are essential for growth. Challenges in mathematics education, particularly in Nigeria, require innovative approaches to improve learning outcomes. Research has shown that modelling activities significantly aid mathematical skill development (Kannadass et al., 2023). Mathematical modelling enhances understanding and improves computational and critical thinking abilities. Integrating STEM education can stimulate interest in STEM fields and equip students with 21st-century skills. This highlights the importance of moving critical thinking from theory to practice and teacher-training programs. Incorporating AI into education can provide personalized learning support (Walter, 2024), which requires training and curriculum adaptation. Enhancing teachers' knowledge of mathematical problem-solving is crucial to supporting students' proficiency (Chapman, 2015). Educators can boost critical thinking by employing strategies that engage students, emphasize the learning process, and use challenging assessments. Rapid technological advancements and changing workforce needs have widened the skill gap, affecting student performance and future prospects.

Research shows that higher education institutions often struggle to align offerings with market needs and emerging research techniques (Börner et al., 2018), creating a gap between skills and job demands. Dynamic skill requirements in data science and engineering have exacerbated this challenge (Börner et al. 2018). Educational institutions must adopt an adaptive approach. Experiential learning activities, like the 3-day residential program by Jackson et al. (2023), show promise for enhancing employability skills. Integrating technology into education can foster critical 21st-century skills. By aligning educational offerings with industry needs and emphasizing technical and soft skills, institutions can prepare students for success in a rapidly evolving economy.

AI is revolutionizing education by enabling personalized, adaptive, and scalable learning, particularly in mathematics. AI tools analyze learning patterns, tailor content, and provide real-time feedback (Onesi-Ozigagun et al. 2024). These technologies improve students' mathematics skills by enhancing their comprehension and performance. AI-driven platforms assess strengths and weaknesses, and create customized learning paths (Onesi-

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Ozigagun et al., 2024). This approach boosts engagement and performance, especially in mathematics. AI-powered virtual tutors offer instant feedback, personalized guidance, and support for critical thinking (Adeleye et al., 2024). However, AI integration presents several challenges. Data privacy, algorithmic bias, and teacher training should be addressed (Tang 2024). Inclusion, equity, and access issues must be considered to benefit all students (Tang 2024). AI can transform mathematics education by providing personalized and adaptive experience. By leveraging AI, educators can create inclusive environments that empower students and prepare them for the digital age.

As AI evolves, its educational impact is expected to grow, improving learning outcomes, and bridging skill gaps. AI integration shows promise in developed countries, but Nigeria's adoption is complex. Although AI is used in Nigerian education, including software modeling and e-learning (Bali, 2024), its implementation is less widespread. Challenges included inadequate funding (42.3%), limited expertise (15.4%), and infrastructural deficiencies (25%) (Festus and Bamidele Emmanuel 2024). Sociolinguistic issues and resistance to change complicated adoption. A study of preservice teachers showed high AI anxiety and moderate adoption, indicating the need for interventions and curriculum changes (Falebita, 2024). AI's potential of AI in Nigerian education has been increasingly recognized. Studies have shown that cultural competence and ethical considerations significantly influence AI content learning among Nigerian high school students (Sanusi and Olaleye 2022). AI-based models have been developed to predict Learning Management System (LMS) determinants, potentially addressing the gap in sustainable education during crises, such as COVID-19 (Cavus et al. 2021).

To bridge the AI adoption gap, Nigerian educational institutions should consider adopting AI practices from advanced nations while addressing local challenges, such as infrastructure, training, and cultural adaptation (Bali, 2024; Festus & Emmanuel, 2024). This approach could enhance student learning opportunities and align Nigerian education with advancements in global AI integration.

Statement of the Problem

Challenges in mathematics education in Nigeria impede students' mastery, resulting in skill deficiencies that constrain their economic development. Traditional teaching approaches often neglect individual learning needs, which leads to diminished student engagement and achievement. Without innovation, Nigeria risks lagging its global competitiveness and technological advancement. This study examined the potential of artificial intelligence to enhance mathematics education in Nigeria, bridge skill gaps, and foster sustainable economic growth.

This research explores AI's potential of AI to revolutionize mathematics education in Nigeria, enhancing student performance, workforce preparation, and economic advancement. By examining practical AI applications and addressing challenges, this study aims to assist policymakers, educators, and technology developers in utilizing AI to transform education.

This study examined AI's role of AI in enhancing mathematics learning in Nigerian secondary and higher education. It evaluated the benefits, challenges, and impacts of AI-driven educational tools, but excluded AI applications in other subjects or informal education.

The primary objective of this study is to explore the impact of AI on the advancement of mathematics education in Nigeria. The study aims to:

i. analyze the current state of mathematics education and the challenges affecting learning outcomes.

ii. investigate how AI-driven educational tools can improve personalized learning experiences.

iii. evaluate the effect of AI on student performance and skill development.

iv. identifying challenges and opportunities related to the integration of AI in Nigerian classrooms.

v. provide practical recommendations for policymakers and educators.

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To achieve the above objectives, the study will address the following research questions:

1. What challenges hinder effective mathematics learning in Nigeria?
2. How can AI-driven tools provide personalized and adaptive learning experiences?
3. What is the impact of AI on students' mathematics performance and skills?
4. What are the barriers to implementing AI in Nigerian educational settings?
5. How can AI in education contribute to economic growth in Nigeria?

LITERATURE REVIEW

Overview of Mathematics Education in Nigeria

Persistent challenges in mathematics education in Nigeria lead to poor student performance, as shown by the high failure rates on national exams. Research indicates that emotional intelligence affects the performance of high-ability students in Nigeria. A study in the Calabar Education Zone linked well-being, self-control, and sociability to mathematics achievement in underachieving, high-ability students. In the state of Anambra, emotional intelligence, self-esteem, and self-efficacy are key to mathematics achievement (Ugwuanyi et al., 2020). A Tanzanian study reported high failure rates in primary and secondary schools, especially lower secondary schools, with girls underperforming because of cultural factors (Mazana et al., 2020). This suggests that cultural factors may affect mathematical performance in African countries. Addressing these challenges in Nigeria requires enhancing the teaching environment, improving classroom instruction, developing teaching skills, and reforming teacher training (Mazana et al. 2020).

Integrating emotional intelligence, self-esteem, and self-efficacy into curricula can improve performance (Ugwuanyi et al., 2020). This negatively impacts mathematics achievement, as shown by the correlation between class size and performance (Graham 2023). Large classes limit personalized interaction and time management, contributing to poor performance (Graham, 2023). Integrating technology with blended learning can enhance engagement and learning pathways. However, a poor ICT infrastructure may hinder these strategies. Innovative approaches, such as flipped classrooms and blended learning can address diverse needs and improve outcomes (Cho et al., 2019). Bridging the skill gap requires stakeholder efforts to address overcrowding, improve teacher training, and implement interventions (Graham 2023).

The Role of Artificial Intelligence (AI) in Education

AI is transforming education, especially mathematics, by enabling personalized and adaptive learning. AI tools analyze student data to provide tailored instruction, feedback, and assessments, thus enhancing engagement and performance (Onesi-Ozigagun et al., 2024). AI offers benefits but presents challenges such as data privacy, algorithmic biases, and teacher training needs (Onesi-Ozigagun et al., 2024). Implementing AI in education requires addressing equity and inclusion (Tang 2024). AI reshapes education by personalizing learning, transforming teaching, and optimizing administration (Onesi-Ozigagun et al. 2024). As AI evolves, its educational impact grows, it improves outcomes, and prepares students for the digital age. Several studies have indicated that the integration of AI tools in mathematics education can have positive effects on student performance and learning outcomes. For instance, (Egara & Mosimege, 2024) reported that teachers who integrated ChatGPT into mathematics teaching observed improved teaching effectiveness, heightened student engagement, and enhanced comprehension of complex concepts (Egara & Mosimege, 2024). However, it's important to note that the effectiveness of AI integration varies and faces challenges. (Egara & Mosimege, 2024) mentions issues such as technical adaptability, curriculum alignment, and the need for customization to accommodate diverse learning styles (Egara & Mosimege, 2024). Research has revealed that mathematics preservice teachers exhibit high levels of AI anxiety, which could affect the adoption and effectiveness of AI tools in classrooms (Falebita, 2024).

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Personalized learning, including AI-driven systems, caters to individual paces and promotes mastery, allowing progress based on competence (Idowu 2024). These systems leverage data to address misconceptions, provide feedback, and adjust instructions (Idowu 2024). The success of mastery learning relies on teacher support, which can be compromised by time constraints or curriculum goals.

AI Applications in Personalized Learning

AI-driven personalized learning tailors education according to students' needs. Intelligent tutoring systems (ITS) use machine learning to analyze performance data and create customized paths aligned with each learner's pace and understanding (Onesi-Ozigagun et al., 2024; Tang, 2024). This boosts engagement and performance through immediate feedback and targeted interventions (Rizvi, 2023). Some studies question the empirical support for learning styles in adaptive systems (Kumar et al., 2017), highlighting the need for research to refine frameworks and address challenges. AI-driven learning can enhance outcomes but requires addressing challenges, such as teacher preparedness, ethics, and adaptive approach evaluation (Castro et al., 2024).

As AI evolves, its educational impact is expected to grow, improving outcomes in the digital age (Onesi-Ozigagun et al., 2024). Adaptive platforms show promise for enhancing mathematics proficiency. These findings underscore the potential of adaptive systems to provide personalized content-supporting curricula. However, a study on ALEKS revealed a decline in skill scores due to a lack of motivation, system complexity, and social presence (Harati et al., 2021), suggesting that implementation must consider user experience. The effectiveness of adaptive platforms in enhancing math proficiency depends on infrastructure, instructor role, and student characteristics (Brugliera 2024). The integration of AI into these platforms, as seen in the Adaptive Personalization Theory of Learning (APT) model, offers promising avenues for improving personalized learning in math education (Ejjami, 2024).

Adaptive Learning Technologies

AI-powered adaptive learning systems personalize education and enhance student outcomes by analyzing performance data and adjusting content difficulty in real-time (Onesi-Ozigagun et al., 2024). By adapting to individual learning paces and providing targeted support, they meet diverse student needs in Nigerian classrooms, thereby boosting engagement and performance. Challenges include ethical concerns such as data privacy, algorithmic bias, and teacher training (Onesi-Ozigagun et al., 2024). Integrating AI requires balancing technology-driven personalization with human interaction with teachers as facilitators (Idowu, 2024). AI-driven adaptive learning can transform Nigerian education into a personalized experience. Success depends on addressing ethical issues, developing educators' skills, and establishing transparent systems (Castro et al. 2024; Ejjami 2024). As AI evolves, its educational impact is expected to grow, enhancing learning outcomes and preparing students for the digital age (Onesi-Ozigagun et al., 2024).

AI for Assessment and Feedback

AI-enabled tools promise to automate and enhance formative assessments, but their effectiveness is context dependent. Studies have shown that AI-driven tools provide timely feedback and reduce workloads. An AI reporting tool in a high school biology class improved learning and self-regulation (Liao et al., 2024). A semi-automated rubric in an undergraduate course cuts marking time by 40% and improves feedback satisfaction (Atkinson & Lim, 2013). In mathematical economics, AI tools such as conversational agents offer real-time support and personalized feedback (Choustoulakis 2024). However, AI assessments face challenges including potential biases, student overreliance, and misunderstandings of AI-generated solutions (Choustoulakis, 2024). Automated grading accuracy varies; in writing evaluation, accuracy differs by error type and student feedback use (Ranalli et al., 2016). Although promising, AI tool implementation requires careful consideration. A blend of AI assessments and human oversight may be the most effective approach. Cosentino et al. (2024) suggested that integrating AI with human instruction would provide complementary feedback and deeper reflection. Future research should focus on effective AI integration, addressing biases, and developing best practices for AI-based assessments.

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Challenges in Implementation

The integration of AI into Nigerian education presents both opportunities and challenges. AI can transform teaching and learning but faces hurdles, such as inadequate infrastructure and resources. As noted by Ibrahim (2024), technical barriers and limited resources hinder AI integration in Nigerian universities. Lin et al. (2023) emphasized that deploying AI requires a significant investment. Wickramanayake and Muhammad Jika (2017) highlighted unreliable internet and unstable electricity as barriers to students' educational use of social media. Therefore, ethical concerns are crucial. Abubakar et al. (2024) raised the issues of data privacy, access inequality, and overreliance on AI, potentially undermining critical thinking. Shahvaroughi Farahani and Ghasemi (2024) warned that algorithmic biases could perpetuate discrimination, especially in marginalized communities. Therefore, a multifaceted approach is required. Abubakar et al. (2024) recommended AI usage guidelines, equitable technology access, and assessments that prioritize critical thinking. Ibrahim (2024) suggests enhanced training for educators to improve AI literacy. Lin et al. (2023) stressed collaborative, multidisciplinary research, and ethical vigilance to ensure that AI serves educational goals while upholding social justice. By addressing these challenges and fostering AI literacy, Nigeria can leverage AI to enhance its teaching and research outcomes (Abubakar et al. 2024, Ibrahim 2024, Lin et al. 2023).

Theoretical Framework

This study is based on educational theories that highlight the importance of personalized and adaptive learning, showcasing AI's ability to cater to the unique needs of each learner.

Constructivist Learning Theory

Constructivist learning theory emphasizes active learner-centered instruction, in which students construct knowledge through experiences and interactions. AI tools support this by offering personalized, interactive learning experiences that encourage exploration and critical thinking (Grubaugh et al. 2023). Constructivism's core idea is that meaningful knowledge is actively constructed in cognitive, cultural, emotional, and social contexts through classroom engagement (Zajda 2021). AI's adaptive capacities align with these principles, offering dynamic learning avenues (Grubaugh et al. 2023). However, the effectiveness of constructivist learning depends on student characteristics, cognitive development, cultural diversity, and teacher strategies (Zajda, 2021). Integrating AI tools with constructivist principles can transform education by enhancing student engagement, self-reflection, and conceptual changes (Grubaugh et al. 2023).

Personalized and Adaptive Learning Models

Personalized and adaptive learning models use AI-driven tools to tailor instruction to individual student needs, recognizing diverse learning paces and mastery requirements. These models employ data analytics to create individualized pathways for learners (Idowu 2024). By assessing learner progress, these systems provide materials tailored for each student, fostering engagement (Idowu 2024). Different adaptive strategies yielded varied results. A study comparing remediation- and continuity-focused approaches found that emphasizing remediation increased learning gains without affecting dropout rates. This underscores the design of adaptive algorithms to optimize the outcomes. AI-powered personalized learning systems offer promising solutions to enhance education (Subhalakshmi et al. 2025). Challenges include teacher training, equitable technology access, and addressing ethical concerns regarding data privacy and algorithmic bias (Castro et al. 2024; Idowu 2024). AI integration into personalized learning holds the potential to transform education by providing tailored experiences that maximize individual potential and relevance in the digital economy (Castro et al., 2024).

Bloom’s Taxonomy and Mastery Learning

Bloom's taxonomy and mastery learning have significantly influenced education. Bloom observed that traditional methods result in varied outcomes and proposed mastery learning to tailor instruction, aiming to close the achievement gaps (Guskey, 2007). Bloom's taxonomy-inspired assessment tools, such as the Blooming Biology Tool (BBT), help science faculties align assessments with teaching and enhance metacognition, adjusting methods, and designing higher-level questions (Crowe et al., 2008). Recent studies have explored AI integration using Bloom's taxonomy and mastery learning. AI systems offer personalized learning paths,

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engagement, and feedback, thus supporting mastery learning (Bilad et al., 2023; Liu et al., 2022). However, AI tools may struggle with higher-order tasks, especially in the "create" category (Nguyen Thanh et al., 2023). This suggests that educators should emphasize higher-level cognitive skills and rethink educational goals to change the professional landscape (Benvenuti et al., 2023; Thanh et al., 2023). Combining Bloom's taxonomy, mastery learning, and AI tools presents opportunities for enhancing education, but careful implementation and research are required to address these challenges (Bilad et al., 2023; Liu et al., 2022).

METHODOLOGY

This study employed a descriptive survey design. The study population included teachers and students from selected secondary and tertiary institutions in the Ondo West Local Government area. Three tertiary institutions and seven secondary schools were randomly selected, with 50 students and two mathematics teachers chosen from each, for a total of 520 respondents. The research instrument was a structured questionnaire with two sections: Section A demographic data and Section B focusing on AI's role in mathematics learning and economic growth in Nigeria. The items used a modified Likert scale (Strongly Agree, Agree, Disagree, Strongly Disagree). The self-administered questionnaires ensured high response rates. The validity and reliability of the questionnaire have been established using multiple methods. Content validity was achieved through literature review and expert consultations. Reliability testing yielded a Cronbach's alpha of 0.82, indicating a high internal consistency. A pilot test and subsequent revisions strengthened the face and content validity. To address logistical challenges, especially in reaching participants in isolated or specialized settings where random sampling was not feasible, a mixed approach was essential. Data analysis employed descriptive statistics for demographics and the research questions, with a mean criterion of 2.50.

RESULTS AND DISCUSSION

Table 1: Frequency and Percentage Distribution of Respondents Demographic Information

Gender	**Role**	**Education Level**	**Location**
Male (377) – 72.5%	**Student (500) – 96.15%**	**Secondary School (350) – 67.31%**	**Urban (420) – 80.77%**
Female (143) – 27.5%	**Teacher (20) – 3.85%**	**Tertiary (170) – 32.69%**	**Rural (100) – 19.23%**
Total (520) – 100%	**Total (520) – 100%**	**Total (520) – 100%**	**Total (520) – 100%**

Table 1 shows that 377 (72.5%) of the respondents were male, while 143 (27.5%) were female.

Research question 1: The integration of AI tools significantly improves students' mathematics learning outcomes in Nigeria compared to traditional teaching methods.

Table 2: Mean response on the integration of AI tools significantly improves students' mathematics learning outcomes in Nigeria compared to traditional teaching methods

SN	**Items**	**SA**	**A**	**D**	**SD**	$\bar{X}$	**SD**
1	Do you agree that AI tools make mathematics more engaging and easier to understand than traditional methods?	362	45	67	46	3.390	1.013
2	Using AI tools in mathematics classes has improved my/my students' problem-solving skills.	261	170	5	84	3.169	1.063
3	AI-driven tools provide immediate feedback that helps me/my students learn better.	285	190	26	19	3.425	0.751

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4	I/my students perform better in mathematics assessments when AI tools are used.	240	195	55	30	3.240	0.860
5	Traditional teaching methods are more effective in teaching mathematics than AI tools.	175	45	282	18	2.725	0.970

Table 2 presents the responses regarding the integration of AI tools into students' performance in mathematics. The mean score range of 2.725 to 3.425 suggests that respondents concurred with the item statements, indicating that the integration of AI significantly enhances students' mathematics learning outcomes in Nigeria compared with traditional teaching methods. The standard deviation indicates that the responses were concentrated around the mean. In (Torres-Peña et al., 2024), the use of AI tools, such as ChatGPT, MathGPT, Gemini, and Wolfram Alpha, in teaching calculus improved students' accuracy in derivative calculations and deepened their understanding of key concepts. These tools create a dynamic, adaptive learning environment that boosts student engagement and motivation. In Nigeria, (Ige & Hlalele, 2017) presented a study conducted in Nigerian secondary schools that found significant effects of computer-aided teaching on students' achievement in Civic Education concepts. Although this study focused on Civic Education rather than mathematics, it demonstrated the potential of technology-enhanced learning in the Nigerian context. However, it is important to note that the effectiveness of AI integration may vary depending on factors such as the subject matter, implementation strategies, and local context.

Research question 2: Personalized AI-driven educational tools are more effective in addressing individual learning needs and bridging skill gaps in mathematics than conventional instructional approaches.

Table 3: Mean response on personalized AI-driven educational tools as an effective method that can addressed individual learning needs and bridging gaps in mathematics skills.

SN	**Items**	**SA**	**A**	**D**	**SD**	$\bar{X}$	**SD**
6	AI tools help me/my students learn at an individual pace better than traditional methods.	417	89	8	6	3.763	0.530
7	The personalized feedback provided by AI tools enhances my/my students' understanding of mathematics.	315	166	23	16	3.500	0.723
8	AI tools identify and address individual weaknesses in mathematics more effectively than teachers.	211	264	25	20	3.281	0.727
9	I/my students feel more confident in mathematics after using AI-driven tools.	309	140	45	26	3.408	0.845
10	Personalized AI tools can bridge skill gaps in mathematics more effectively than traditional teaching.	297	178	24	21	3.444	0.763

Table 3 presents the respondents' perspectives on the efficacy of personalized AI-driven educational tools in addressing individual learning needs and bridging gaps in mathematics skills. The mean scores (3.763, 3.500, 3.281, 3.408, and 3.444) indicate respondents' consensus that personalized AI-driven educational tools are more effective in meeting individual learning needs and bridging skill gaps in mathematics than traditional instructional methods. AI-driven personalized learning tools have shown promise in addressing individual learning needs and bridging the gaps in mathematics skills. These tools can adapt to students' progress, performance, and preferences; deliver tailored content; and provide immediate feedback (Inoferio et al., 2024; Rasheed et al., 2023). For instance, AI-powered adaptive learning systems can analyze student performance data to create customized learning paths, ensuring that students receive content at their own pace and level of understanding (Onesi-Ozigagun et al., 2024). Interestingly, some studies have found that students turn to AI models as a coping mechanism to alleviate math anxiety and boost their self-assurance. These AI models function

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as "mentors" and "math companions" that offer step-by-step explanations and personalized support, making mathematics more accessible to students (Inoferio et al., 2024). This suggests that AI tools may have psychological benefits in addition to academic benefits.

Research question 3: The successful adoption of AI tools in mathematics education is significantly influenced by factors such as digital infrastructure, teacher competency, and funding availability.

Table 4: Mean response on the successful adoption of AI tools in mathematics education as it significantly influenced factors such as digital infrastructure, teacher competency, and funding availability.

SN	Items	SA	A	D	SD	$\bar{X}$	SD
11	Lack of internet connectivity and digital devices limits the use of AI tools in mathematics education.	369	102	28	21	3.575	0.771
12	Inadequate teacher training is a major barrier to the successful use of AI in mathematics classrooms.	321	154	24	21	3.490	0.765
13	The cost of AI tools is a significant challenge to their adoption in Nigerian schools.	221	198	58	43	3.148	0.919
14	Effective use of AI in mathematics requires technical skills that many teachers currently lack.	285	152	53	30	3.331	0.878
15	Government support and funding are essential for the successful integration of AI in mathematics education.	311	142	25	42	3.388	0.905

As indicated in Table 4, the effective integration of AI tools in mathematics education has significantly influenced digital infrastructure, teacher competencies, and funding availability. This is evidenced by mean values ranging from 3.148 to 3.575, which surpass the mean threshold of 2.50. This result is in agreement with previous works. For instance, (Wijaya et al., 2024) mentioned that AI enhances mathematics instruction through personalized learning experiences and improves data analysis. It also highlights the impact on teachers' skill development, including problem-solving, critical thinking, and collaboration (Wijaya et al., 2024). Interestingly, there were some contradictions between the findings. While AI integration shows positive impacts, Wijaya et al., (2024) also suggest that increased AI literacy and trust correlate with higher AI dependency and a decrease in essential skills, such as self-confidence and creative thinking. This indicates the need for balanced approaches to AI integration in education (Wijaya et al., 2024). These impacts extend to digital infrastructure, teacher competencies, and potential funding allocation, although the exact extent varies across different studies and contexts.

Research question 4: The integration of AI in mathematics education contributes significantly to developing digital skills and workforce readiness, thereby fostering economic growth in Nigeria.

Table 5: Mean response on the integration of AI in mathematics education contributes significantly to developing digital skills and workforce readiness, thereby fostering economic growth in Nigeria.

SN	Items	SA	A	D	SD	$\bar{X}$	SD
16	AI tools help students develop critical thinking and problem-solving skills relevant to the workforce.	223	167	79	51	3.081	0.983
17	The use of AI tools in mathematics education prepares students for digital careers and the future workforce.	289	203	22	6	3.490	0.635
18	AI-driven mathematics education can reduce unemployment by equipping students with relevant skills.	301	212	5	2	3.562	0.537

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19	Students using AI tools are more likely to pursue careers in science, technology, engineering, and mathematics (STEM).	237	192	51	40	3.204	0.906
20	AI integration in mathematics education can significantly contribute to Nigeria's economic growth.	332	121	29	38	3.437	0.892

As indicated in Table 5, incorporating AI into mathematics education plays a crucial role in enhancing digital skills and preparing the workforce, which in turn promotes economic development in Nigeria. This concurs with the results of previous research. For instance, (Bali, 2024) noted a "growing demand for the application of AI technology in the educational landscape of Nigeria" (Bali, 2024). This trend suggests that incorporating AI into various subjects including mathematics can contribute to the development of digital skills among students.

SUMMARY AND RECOMMENDATIONS

Summary

This study examines the potential of Artificial Intelligence (AI) to enhance mathematics education, address skill gaps, and foster economic growth in Nigeria. The findings reveal that AI-driven educational tools significantly improve students' comprehension and mastery of mathematical concepts through personalized, adaptive, and interactive learning experiences. Students utilizing AI tools reported increased engagement, confidence, and proficiency in mathematics, while educators acknowledged the effectiveness of AI in delivering tailored instruction and reducing administrative burdens. However, the study also identified challenges hindering the widespread adoption of AI in Nigerian classrooms, including inadequate digital infrastructure, limited access to technological tools, a lack of digital skills among teachers, and concerns regarding data privacy and algorithmic bias. These challenges underscore the necessity for comprehensive and context-specific solutions to effectively integrate AI into Nigeria's education system. The study concludes that AI holds transformative potential to bridge educational skill gaps, equip students with essential competencies for the 21st-century workforce, and drive economic development in Nigeria. Successful implementation of AI in mathematics education requires strategic investment, policy support, and collaborative efforts among stakeholders.

Recommendation

To maximize the benefits of AI in enhancing mathematics learning and contributing to economic growth in Nigeria, the following recommendations are proposed:

Strengthen Digital Infrastructure and Access: The Nigerian government and private sector should invest in reliable internet connectivity, digital devices, and electricity supply, particularly in rural and underserved areas. Subsidies or public-private partnerships could be explored to make digital tools and AI technologies more affordable for students and teachers.

Capacity Building for Teachers and Educators: Implement comprehensive training programs to equip teachers with digital literacy skills and the ability to effectively integrate AI tools into classroom instruction. Continuous professional development should be provided to ensure teachers remain proficient in AI-driven pedagogies.

Policy and Regulatory Frameworks: Develop clear policies and guidelines for AI adoption in education, addressing issues related to data privacy, algorithmic fairness, and ethical AI use. Establish standards for AI tools to ensure their reliability, safety, and alignment with national educational objectives.

Localized AI Solutions for Nigerian Classrooms: Encourage the development of AI tools tailored to the Nigerian educational context, including offline capabilities and local language support. Foster collaboration between AI developers, educators, and policymakers to design solutions that address specific learning challenges.

Pilot AI-Driven Educational Programs: Conduct pilot projects in selected schools to evaluate the effectiveness of AI tools in improving mathematics learning outcomes. Scale up successful initiatives based on lessons learned from pilot implementations.

Monitor and Evaluate AI Implementation: Establish a robust monitoring and evaluation framework to assess the impact of AI tools on mathematics education. Regularly review and refine AI-driven educational strategies based on empirical evidence.

Promote Public Awareness and Stakeholder Engagement: Increase awareness among parents, students, and educators about the benefits of AI in education. Foster stakeholder collaboration, including partnerships between government, tech companies, educational institutions, and NGOs.

This study provides a snapshot of current perceptions. Future study will include longitudinal research to access the long-term impact of AI integration on mathematics learning and economic outcomes. Future research should focus on quantifying these impacts more precisely to guide effective AI integration strategies in mathematics education.

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