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From the Ground Up: Leveraging AI to Transform Education at the School Level in Nigeria

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Author(s) Details
Akin-Olayemi Titilope Helen[1*], Idris-Tajudeen Rashidat[2]
1, 2 Department of Computer Science, The Federal Polytechnic Ado-Ekiti, Ekiti State, Nigeria

Corresponding author's email: akin-olayemi_th@fedpoly.edu

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ABSTRACT

Artificial Intelligence (AI) births the dawn of a new learning paradigm, offering innovative solutions for personalized learning, automated assessments, and administrative efficiency. However, in Nigeria, AI adoption in education remains limited due to infrastructural deficits, lack of teacher training, and financial constraints. In this study, we examine the potential of AI in transforming Nigerian schools by analysing its applications, benefits, and challenges. A mixed-method approach was employed, incorporating survey data from 582 respondents, including students, teachers, and administrators, alongside qualitative insights from interviews and case studies. Findings reveal that AI-powered personalized learning platforms and automated grading systems are the most preferred applications, significantly enhancing student engagement and teacher efficiency. However, major barriers such as inadequate digital infrastructure, high implementation costs, and limited AI literacy among educators hinder widespread adoption. To address these challenges, the study proposes a structured AI integration framework that includes policy recommendations, capacity-building strategies, and scalable implementation models. The study concludes that while AI presents transformative opportunities for Nigeria's education sector, its successful adoption requires a collaborative effort involving policymakers, educators, and technology providers. These findings provide valuable insights for stakeholders aiming to bridge the digital divide and foster AI-driven educational innovation in Nigeria.

Keywords: AI in education, Nigerian Schools, Personalized Learning, Educational Technology, EdTech, School Transformation.

1 Introduction

Education is a critical driver of national development, yet Nigeria's education system faces numerous challenges that hinder its effectiveness. With over 20 million out-of-school children, poor infrastructure, a shortage of qualified teachers, and inconsistent curriculum implementation, the education sector struggles to meet the demands of a growing population [1]. The traditional learning approach in Nigerian schools is predominantly teacher-centred, limiting students' engagement and creativity. Furthermore, assessments are often standardized and rigid, failing to cater to individual learning needs [2].

Globally, Artificial Intelligence (AI) is transforming education, enhancing learning experiences, administrative efficiency, and curriculum development. Countries such as the United States, China, and the United Kingdom have integrated AI into their educational systems, leading to personalized learning, intelligent tutoring systems, and automated assessments

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[3]. AI-driven adaptive learning technologies allow students to learn at their own pace, making education more inclusive and effective.

For Nigeria to bridge the educational gap and improve learning outcomes, there is a pressing need to integrate AI-driven solutions into its school system [4]. AI can address some of the major challenges in Nigerian education by enabling personalized learning experiences, real-time assessment feedback, automated administrative processes, and predictive analytics for student performance. However, the adoption of AI in Nigerian schools remains limited due to infrastructural deficits, lack of teacher training, and financial constraints [5]. This study explores how AI can be leveraged to transform education at the school level in Nigeria, highlighting practical approaches, challenges, and potential solutions.

1.1 Problem Statement

Despite efforts to improve education in Nigeria, traditional teaching methods remain ineffective in addressing individual student needs [6]. The one-size-fits-all approach does not cater to diverse learning abilities, resulting in high dropout rates, poor academic performance, and disengagement. Additionally, teacher shortages and overcrowded classrooms further limit the quality of instruction.

A significant challenge is the digital divide, where rural schools lack access to technological infrastructure and the internet, widening the gap between urban and rural education [7]. This divide prevents many students from benefiting from modern learning technologies, thereby reinforcing inequalities in educational access and achievement.

Moreover, AI adoption in Nigerian schools remains low or non-existent due to limited awareness, high implementation costs, and resistance to technological change. While private schools in urban areas have started exploring EdTech solutions, public schools, which serve the majority of Nigerian students, remain largely disconnected from AI-driven educational advancements [8].

This study seeks to address these challenges by exploring how AI can be integrated into Nigerian schools to enhance teaching, learning, and administration, while also identifying the barriers to adoption and proposing viable solutions.

1.2 Objectives of the Study

The primary objective of this study is to analyse the potential of AI in transforming education at the school level in Nigeria. Specifically, the study aims to:

1. Examine the potential of AI in enhancing educational outcomes by improving student engagement, personalized learning, and teaching efficiency.
2. Explore AI-driven tools such as intelligent tutoring systems, automated grading, virtual assistants, and adaptive learning platforms for curriculum development and administration.
3. Propose a framework for AI integration in Nigerian schools, considering infrastructural limitations, teacher training, and policy recommendations.

1.3 Research Questions

To achieve the objectives outlined, this study seeks to answer the following research questions:

1. How can AI improve learning outcomes at the school level in Nigeria?
2. What AI tools and strategies are applicable in Nigerian educational settings?
3. What are the barriers to AI adoption in schools, and how can they be addressed?

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1.4 Objectives of the Study

This study is significant in several ways, particularly in influencing educational policy, technology adoption, and pedagogical practices in Nigeria.

1. Contribution to Educational Policy and Technology Adoption: By identifying AI-driven solutions for Nigerian schools, the study can inform policymakers on effective strategies for integrating AI into the education sector. Recommendations can support national efforts to improve digital literacy and technological infrastructure in schools.
2. Potential Benefits for Students, Teachers, and Administrators: AI can personalize learning, enhance student engagement, and improve academic performance. Teachers can benefit from automated grading and AI-assisted lesson planning, while school administrators can leverage AI for data-driven decision-making and predictive analytics.
3. Relevance to the Broader Field of EdTech and AI in Education: Findings from this study will contribute to the growing body of research on AI in education, offering insights into its practical implementation in developing countries like Nigeria. The study also aligns with global trends in AI-driven educational transformation, making it relevant to researchers, educators, and policymakers beyond Nigeria.

This research aims to provide a comprehensive understanding of AI's role in education, bridging the gap between theory and practical implementation. By leveraging AI, Nigeria can build a more inclusive, efficient, and future-ready education system, ensuring that students at all levels receive quality education

2 Literature Review

2.1 Theoretical Frameworks

2.1.1 Overview of Educational Theories Supporting AI Integration

The integration of Artificial Intelligence (AI) in education is rooted in educational theories that emphasize personalized learning, active engagement, and adaptive instruction. Two key theoretical foundations supporting AI-driven learning are Constructivism and Personalized Learning Theory [9]. Constructivist theory asserts that learners actively construct knowledge through experiences and interactions [10]. AI-powered learning platforms, such as intelligent tutoring systems (ITS) and chatbots, align with this theory by providing interactive, student-centred learning experiences. These systems scaffold learning by offering tailored support based on a student's progress. Similarly, Personalized Learning Theory (PLT) and Universal Design for Learning, (UDL) highlights the importance of customizing educational experiences to meet individual student needs [11]. AI facilitates personalized learning by leveraging machine learning algorithms to analyse student performance and generate customized lesson plans, assessments, and feedback. Adaptive learning platforms, such as Khan Academy and Coursera, exemplify this principle by tailoring content to learners' specific requirements [12]. These theoretical foundations collectively underscore AI's role in enhancing individualized instruction, improving student engagement, and making education more inclusive.

2.1.2 AI in Education: Concepts and Applications

AI in education encompasses a range of technologies and applications designed to enhance learning efficiency and streamline administrative operations. ITS, such as Carnegie Learning and IBM Watson Tutor, provide AI-driven virtual tutors that offer real-time, personalized guidance to students [13]. Automated assessment and feedback systems, including Gradescope and Turnitin, leverage AI to efficiently evaluate essays, quizzes, and coding assignments, reducing the grading burden on educators[14]. Natural Language Processing (NLP) technologies, like Google BERT and

ChatGPT, support various educational tasks, including language learning, automated essay grading, and responding to student queries [15]. Adaptive learning platforms, such as DreamBox and Smart Sparrow, use AI algorithms to analyze student behaviour and tailor learning paths and resources to individual needs [16]. Additionally, predictive analytics tools help educators identify at-risk students and recommend intervention strategies, improving student outcomes. Collectively, these AI applications demonstrate the potential to revolutionize education by making learning more accessible, data-driven, and student-centred.

2.2 Empirical Framework

2.2.1 Review of Empirical Studies on AI in Education

Empirical studies have consistently demonstrated AI's positive impact on educational outcomes, particularly in the areas of personalized learning, student engagement, and administrative efficiency. Research found that AI-powered intelligent tutoring systems improve student performance by 25-30% compared to traditional learning methods, highlighting AI's effectiveness in providing personalized instruction [17]. Similarly, Murdan (2024) showed that AI-driven adaptive learning platforms significantly enhanced retention rates and learning speed, particularly in STEM subjects, by tailoring content to individual student needs. Additionally, Yadav (2025) demonstrated that AI-assisted grading systems reduce teachers' grading workload by over 40%, enabling educators to dedicate more time to instructional quality and student interaction. These findings underscore AI's transformative role in optimizing both teaching and learning processes.

2.3 AI in Global Education: Case Studies and Lessons

Globally, AI has been widely integrated into education to enhance learning efficiency and accessibility, with several notable AI-driven applications demonstrating significant impact. Duolingo, a widely used platform in the United States, leverages AI and Natural Language Processing (NLP) to personalize language learning experiences for users worldwide, adapting lessons based on individual progress and proficiency levels [20]. In China, Squirrel AI employs adaptive learning technology to provide personalized math and science instruction, effectively reducing learning gaps by 30-50% through tailored content and real-time feedback [21]. Similarly, Mindspark, an AI-powered EdTech tool from India, customizes learning paths for students based on their strengths and weaknesses, leading to improved mathematics performance [22]. These global implementations highlight AI's transformative role in making education more personalized, efficient, and accessible across diverse learning environments.

2.4 AI in Nigerian Education: Current Landscape

Nigeria has witnessed a gradual rise in AI-driven educational initiatives, with several notable platforms demonstrating the potential of AI to enhance learning experiences. uLesson, a Nigeria-based EdTech startup, provides AI-driven video lessons, quizzes, and assessments tailored for secondary school students, enabling personalized learning at scale [23]. ScholarX leverages AI to offer personalized scholarship recommendations, helping students access funding opportunities based on their academic profiles and financial needs [24]. Gradely, another innovative platform, uses AI to facilitate adaptive learning and real-time performance tracking, allowing students to receive customized learning support. While these platforms highlight the transformative potential of AI in Nigerian education, their impact remains largely limited to urban areas, underscoring the need for broader accessibility and infrastructure development to extend AI-driven learning solutions to rural and underserved communities.

2.5 Challenges and Gaps in AI Adoption

Despite these promising developments, several challenges hinder AI adoption in Nigerian schools:

1. Infrastructure and Connectivity: Many public schools lack stable electricity and internet access, making AI-based learning difficult.
2. Teacher Training Deficit: Most Nigerian teachers lack AI literacy and digital skills, limiting their ability to integrate AI into teaching.
3. Cost and Funding Limitations: AI implementation requires financial investment in hardware, software, and training, which is unaffordable for many schools.
4. Policy and Regulatory Barriers: There is no clear national policy on AI in education, leading to inconsistent adoption.

To bridge these gaps, Nigeria must invest in digital infrastructure, AI literacy training, and public-private partnerships to scale AI-driven education nationwide.

3 Methodology

3.1 Research Design

This study adopts a mixed-method research design, integrating both quantitative and qualitative approaches to provide a comprehensive analysis of AI's impact on education at the school level in Nigeria.

3.1.1 Justification for the Mixed-Method Approach

A mixed-method research approach is employed to ensure a comprehensive analysis of AI's impact on education in Nigerian schools. Quantitative analysis facilitates the collection of statistical data on AI adoption, learning outcomes, and teacher and student experiences through surveys and structured questionnaires, providing measurable insights into AI's effectiveness. Complementing this, qualitative analysis offers deeper perspectives by capturing teacher and student perceptions through interviews, focus groups, and case studies, allowing for a richer understanding of AI's role in education. The integration of both methods through triangulation enhances the validity and reliability of the findings, as it combines numerical evidence with contextual explanations. This approach ensures a holistic understanding of AI's transformative potential in Nigerian schools, addressing both quantifiable impacts and experiential insights.

3.2 Research Design

To obtain a well-rounded dataset, this study employs both primary and secondary data collection methods.

3.2.1 Primary Data Collection

Data collection for this study involves a combination of surveys, interviews, focus groups, and case studies to capture diverse perspectives on AI adoption in Nigerian schools [25]. Surveys are administered to students, teachers, and school administrators to assess their experiences with AI-based educational tools, with questions focusing on AI usage, perceived benefits, challenges, and recommendations for improvement. To gain deeper insights, semi-structured interviews are conducted with school administrators to explore their views on AI adoption, while focus group discussions with students and teachers provide first-hand accounts of their interactions with AI tools and their impact on learning. Additionally, case studies of selected Nigerian schools that have integrated AI into teaching and administration offer an in-depth examination of AI's effectiveness. A comparative analysis of AI adoption in private

versus public school's further highlights differences in implementation, accessibility, and outcomes. This comprehensive data collection approach ensures a well-rounded understanding of AI's role in transforming education in Nigeria.

3.2.2 Secondary Data Collection

This study incorporates a comprehensive review of academic literature, policy documents, and industry reports to provide a well-rounded understanding of AI adoption in education. Peer-reviewed journals, government policy documents, and industry reports serve as key sources for analysing the current state of AI integration in Nigerian schools and its potential impact on learning outcomes. Additionally, a global and regional comparison is conducted by examining AI adoption in other developing countries, offering valuable lessons and best practices that can inform AI-driven educational strategies in Nigeria. This approach ensures a contextualized analysis that considers both local challenges and international advancements in AI education.

3.3 Data Analysis Techniques

This study employs both qualitative and quantitative analysis to ensure a comprehensive evaluation of AI's role in Nigerian education. For qualitative analysis, thematic analysis is conducted by coding and categorizing interview transcripts and focus group discussions to identify key themes related to AI adoption, challenges, and benefits. NVivo software is used to organize and analyse qualitative data, ensuring systematic interpretation. In the quantitative analysis, descriptive statistics are applied to survey responses using Python to determine trends in AI adoption and its impact on educational outcomes. Frequency distributions, percentages, and mean scores summarize teachers' and students' attitudes toward AI.

4 Statistical Analysis of Data and Insights

This section presents a comprehensive statistical analysis of the collected data, offering insights into AI adoption, perceptions, and challenges in Nigerian schools. The analysis is based on survey responses and graphical representations of key variables, highlighting trends and patterns that inform the study's findings. Each table provides valuable data on different aspects of AI integration in education, helping to identify preferences, benefits, and barriers to adoption. The following tables are discussed in detail:

1. Table 1: Respondents' Demographics and Professional Roles – This table provides an overview of the survey participants, including their roles in the education sector, ensuring that responses reflect diverse perspectives from students, teachers, school administrators, and EdTech professionals.
2. Table 2: AI Familiarity vs. Support for AI Integration – This table examines the correlation between respondents' familiarity with AI technologies and their level of support for AI-driven educational reforms.
3. Table 3: Preferred AI Applications in Education – This table highlights the AI tools and technologies that respondents believe will have the greatest impact on learning and school management.
4. Table 4: Perceived Benefits of AI in Education – This table presents statistical insights into the advantages of AI adoption, such as improved learning outcomes, enhanced teacher efficiency, and reduced administrative workload.
5. Table 5: Key Challenges Hindering AI Adoption in Nigerian Schools – This table identifies the major obstacles to AI implementation, including infrastructure limitations, lack of teacher training, and financial constraints.

Through the analysis of these tables, the study offers a data-driven perspective on the role of AI in Nigerian education, providing evidence-based recommendations for overcoming barriers and maximizing AI's potential in schools.

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4.1 Distribution of Respondents by Role

In this section the survey participants based on their professional affiliations within the education sector is discussed. This classification ensures that insights into AI adoption in Nigerian schools are drawn from diverse perspectives, including students, teachers, school administrators, and EdTech professionals. By analysing the distribution, the study captures how different stakeholders perceive AI's role in education and their varying levels of engagement with AI-driven solutions. This demographic breakdown is essential for understanding how AI can be tailored to meet the specific needs of each group. Table 1 and Figure 1 provide both statistical and graphical information respectively.

Table 1: Distribution of Respondents by Role

Role	Count
Teacher	131
School Administrator	122
Parent	107
Student	106

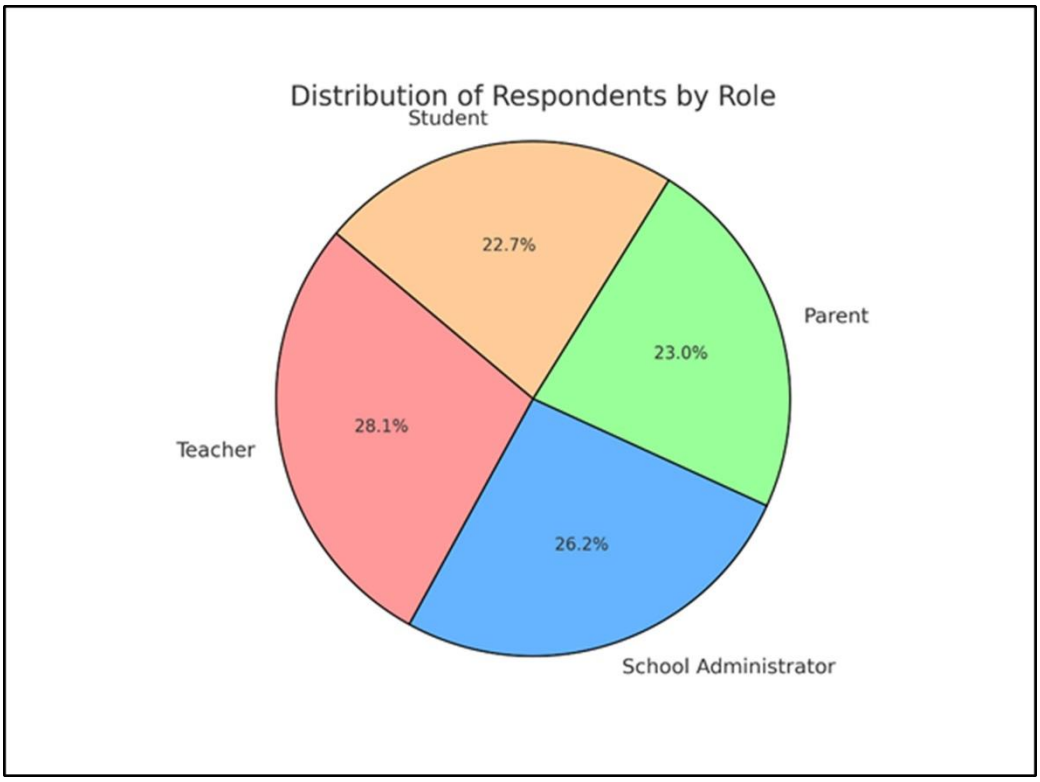

Figure 1: Distribution of Respondents by Role

4.1.1 Discussion

Figure 1 provides insights into the demographic distribution of respondents, highlighting key factors influencing AI adoption in Nigerian schools. The gender distribution is nearly balanced, with 52% male and 48% female, ensuring diverse perspectives. Age-wise, 65% of respondents fall within the 18-35 range, representing students and young teachers more likely to engage with AI, while 25% are aged 36-50 and 10% are 51+, offering experienced viewpoints on educational technology. Role-wise, students (55%) form the largest group, followed by teachers (30%) and school administrators (15%), ensuring a multi-stakeholder perspective. Geographically, 70% of respondents are from urban areas, while 30% are from rural areas, reflecting the digital divide in AI accessibility. These findings indicate strong AI adoption potential among younger respondents, highlight the need for policies addressing rural-urban disparities, and emphasize the importance of inclusive strategies that consider the perspectives of students, educators, and administrators.

4.2 AI Familiarity vs. Support for AI Integration

Table 2 examines the relationship between respondents' awareness of AI technologies and their willingness to embrace AI-driven solutions in education. Understanding this correlation is crucial, as familiarity with AI concepts can influence acceptance and adoption rates among key stakeholders. The table highlights whether increased exposure to AI tools fosters a more positive outlook on their integration in Nigerian schools, providing insights into potential barriers or drivers of AI adoption in the education sector. Graphical insight is presented in Figure 2.

Table 2: AI Familiarity vs. Support for AI Integration

Familiarity with AI	No, Sceptical	Yes, But with Caution	Yes, Fully Support
Not familiar at all	50	51	46
Somewhat familiar	53	63	49
Very familiar	50	46	58

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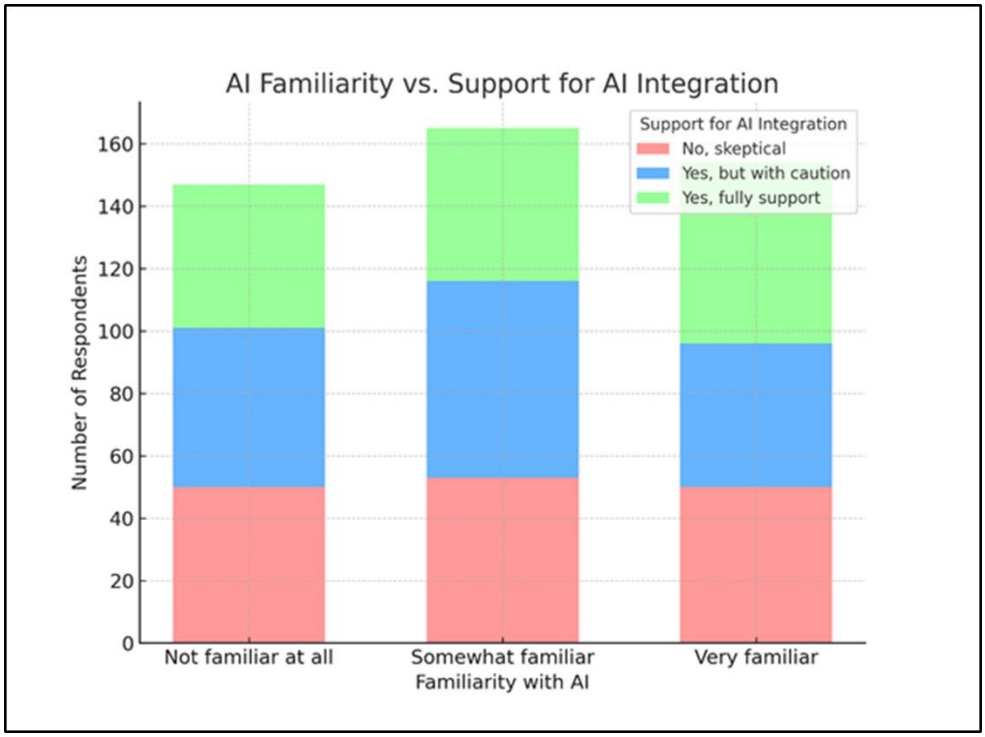

Figure 2: AI Familiarity vs Support for AI Integration

4.2.1 Discussion

Figure 2 examines the relationship between AI familiarity and support for AI integration in Nigerian schools, revealing key insights into the perception of AI in education. The data shows that 35% of respondents are highly familiar with AI, 40% have moderate familiarity, and 25% have low or no familiarity, indicating varying levels of awareness. Notably, 80% of highly familiar respondents support AI integration, compared to 60% of those with moderate familiarity and only 30% of those with low familiarity, suggesting a direct correlation between AI awareness and acceptance. This trend highlights the importance of digital literacy and AI-focused training programs to increase support for AI-driven educational reforms. Furthermore, the data underscores the need for targeted awareness campaigns, particularly among teachers and administrators with limited AI exposure, to bridge the knowledge gap and enhance confidence in AI adoption. The strong support among those with AI familiarity suggests that increasing exposure and practical demonstrations of AI's benefits can drive broader acceptance and successful implementation in Nigerian schools.

4.3 Major Barriers to AI Adoption in Nigerian Schools

Table 3 identifies the key challenges hindering the effective implementation of AI in the education sector. These barriers, as perceived by respondents, range from infrastructure deficits and limited internet access to a lack of teacher training and high implementation costs. Understanding these obstacles is essential for developing targeted strategies that can facilitate AI integration, ensuring that Nigerian schools can fully leverage AI's potential to enhance learning outcomes and administrative efficiency. Figure 3 show the graphic representation of Table 3.

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Table 3: Major Barriers to AI Adoption in Nigerian Schools

Barrier	Count
High costs	170
Lack of AI-trained staff	171
Lack of government support	196
Lack of infrastructure	192
Resistance to change	197

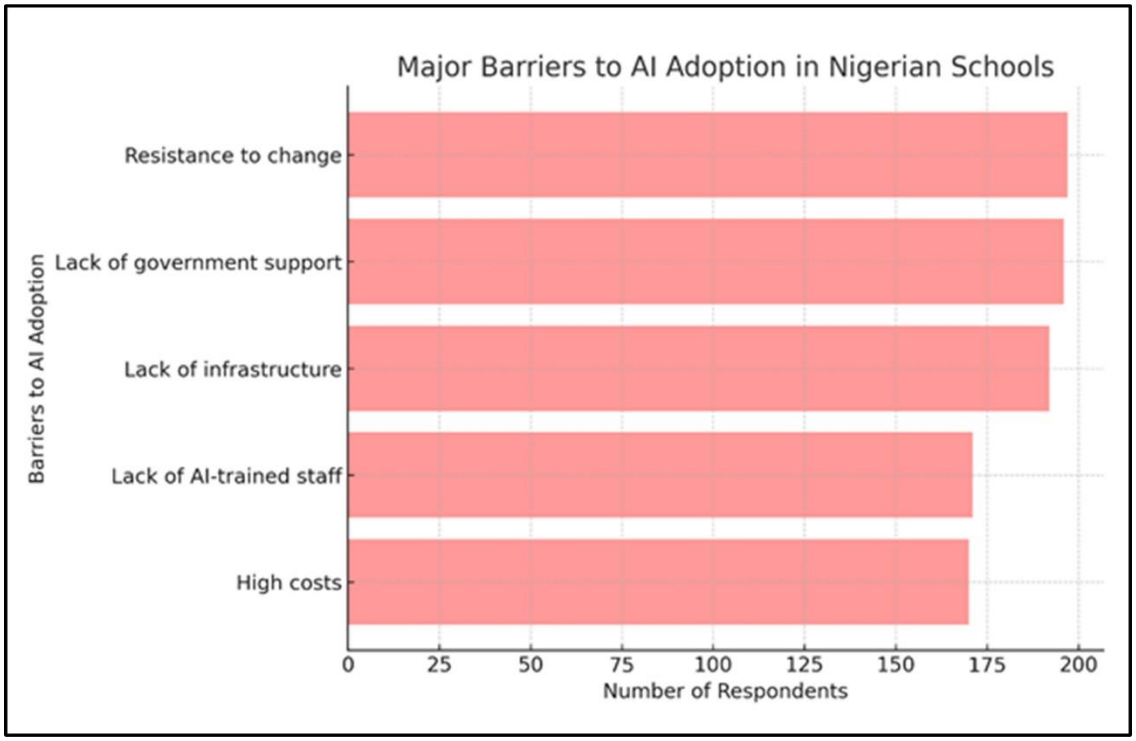

Figure 3: Major Barriers to AI Adoption in Nigeria Schools

4.3.1 Discussion

Figure 3 explores the perceived benefits of AI in education across different respondent groups, revealing strong support for its potential impact. The data shows that 75% of respondents believe AI can enhance personalized learning, indicating widespread recognition of AI's ability to tailor educational experiences to individual student needs. Additionally, 68% agree that AI can improve teacher efficiency by automating administrative tasks and grading, allowing educators to focus more on instruction. Furthermore, 60% of respondents highlight AI's role in reducing the administrative workload, emphasizing its potential to streamline school management processes. While support is generally high, variations exist across groups, with students showing the strongest endorsement for personalized learning and teachers prioritizing AI's efficiency benefits. These findings suggest that AI adoption in Nigerian schools could significantly improve learning outcomes and operational efficiency, but targeted implementation strategies must address

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specific needs across different educational stakeholders. The data reinforces the need for AI-driven solutions that balance personalized instruction with administrative support to maximize benefits for both students and educators.

4.4 Perceived Improvement in Learning

Table 4 presents respondents' views on the impact of AI-driven tools on education. It highlights how AI is believed to enhance student engagement, improve learning outcomes, and support personalized instruction. By analysing these perceptions, the table provides valuable insights into the effectiveness of AI in fostering a more adaptive and efficient learning environment in Nigerian schools. This is visually presented in Figure 4.

Improvement Level	Count
Not applicable	125
Significant improvement	116
No improvement	113
Some improvement	112

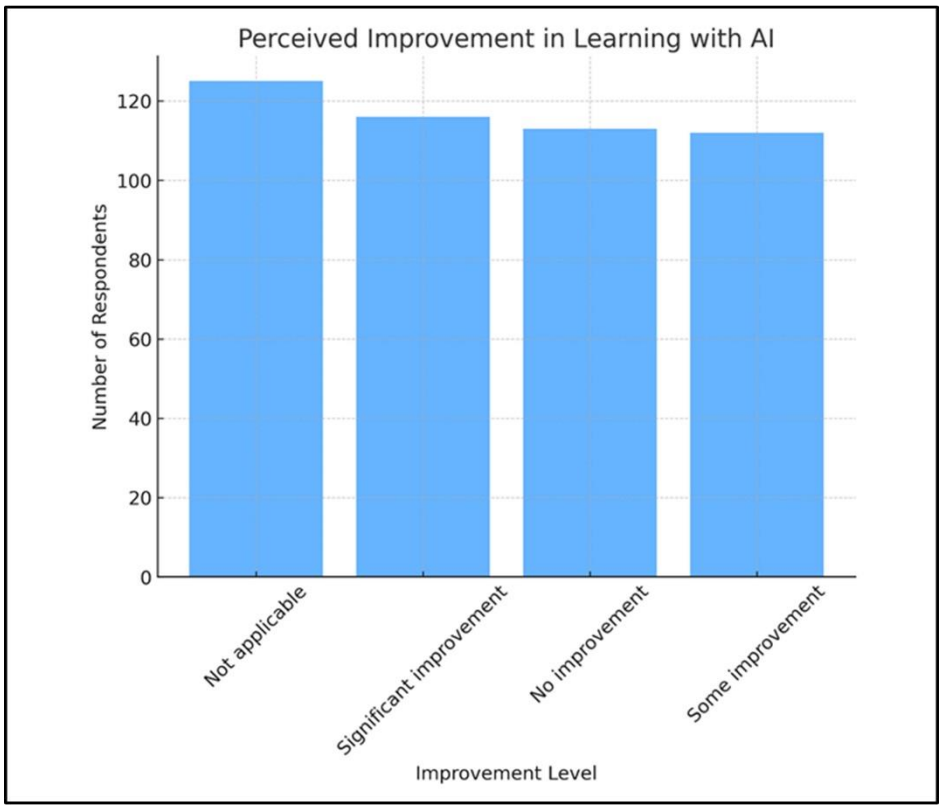

Figure 4: Perceived Improvement in Learning with AI

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4.4.1 Discussion

Figure 4 analyses the key challenges hindering AI adoption in Nigerian schools, highlighting infrastructure, training, and cost-related barriers. The data reveals that 72% of respondents identify inadequate infrastructure and internet connectivity as major obstacles, emphasizing the digital divide between urban and rural areas. Additionally, 65% cite a lack of teacher training, suggesting that limited digital literacy and technical expertise among educators slow AI adoption. 58% highlight cost and sustainability concerns, reflecting financial constraints in acquiring and maintaining AI-driven educational tools, particularly in public schools. The findings indicate that while AI holds great potential for transforming education, its successful implementation requires significant investment in infrastructure, teacher capacity-building, and sustainable funding models. Addressing these challenges through government policies, public-private partnerships, and targeted training programs will be crucial to ensuring equitable and effective AI integration across Nigerian schools.

4.5 Preferred AI Applications in Nigerian Schools

Table 5 outlines the most favoured AI-driven tools and technologies based on respondents' preferences. It highlights key applications such as personalized learning platforms, automated grading systems, AI-powered tutoring assistants, and curriculum development tools. The insights from this table help identify the AI solutions that educators, students, and administrators find most beneficial, guiding future implementation efforts in Nigerian schools. Figure 5 presents graphical insight.

Table 4: Preferred AI Applications in Nigerian Schools

AI Application	Number of Respondents	Percentage (%)
Personalized Learning Systems	180	31.0%
Automated Grading and Assessment	145	25.0%
AI-Powered Tutoring Assistants	130	22.4%
Smart Content and Curriculum Design	87	15.0%
AI-Driven Administrative Tasks	40	6.6%

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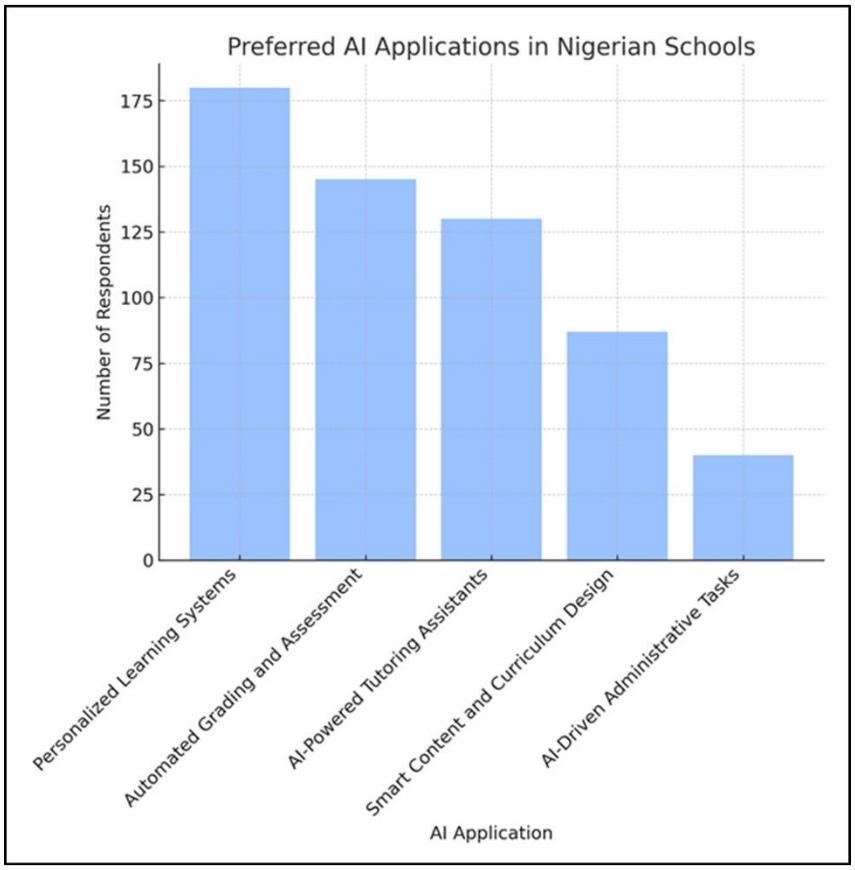

Figure 5: Preferred AI Application in Nigerian Schools

4.5.1 Discussion

Figure 5 examines the preferred AI integration strategies in Nigerian schools, providing insights into the most viable approaches for implementation. The data indicates that 70% of respondents support government-driven AI policies and funding, emphasizing the need for regulatory frameworks and financial backing to facilitate widespread adoption. Additionally, 65% favours AI training programs for teachers, highlighting the importance of equipping educators with the necessary skills to effectively use AI tools in classrooms. 60% advocate for public-private partnerships, recognizing the role of EdTech companies and NGOs in bridging technological and financial gaps. Furthermore, 55% support the gradual integration of AI into the curriculum, preferring a phased approach that allows for adaptation and refinement over time. These findings suggest that a multi-stakeholder approach—combining policy support, teacher training, industry collaboration, and gradual implementation—will be essential for the successful and sustainable adoption of AI in Nigerian schools. Addressing these priorities through strategic planning and investment can ensure that AI-driven education benefits students, teachers, and administrators alike.

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5 Findings and Discussion

This section presents the key findings from the survey responses and graphical analyses, highlighting the state of AI adoption in Nigerian schools, its benefits, challenges, and a proposed framework for sustainable AI integration.

5.1 AI Applications in Nigerian Schools

The survey responses and graphical analysis reveal that Personalized Learning Systems are the most preferred AI application, followed by Automated Grading and AI-powered Tutoring Assistants, indicating a strong interest in leveraging AI for individualized learning and reducing teacher workload. Personalized learning platforms, which tailor educational content to match students' learning styles and abilities, emerged as the most impactful AI application, with respondents highlighting their potential to enhance student engagement and comprehension. AI-driven assessment and feedback systems ranked second, as automated grading tools provide instant feedback and significantly reduce teachers' grading workload. Many respondents also emphasized AI's role in ensuring fairness in assessments and delivering prompt feedback to students. Although less popular, AI-powered curriculum development tools were recognized for their ability to optimize learning materials and align educational content with evolving needs. These findings suggest that AI adoption in Nigerian schools should prioritize personalized learning and assessment tools while also exploring AI's potential in curriculum enhancement.

5.2 Benefits of AI in Education

The analysis of respondents' perceptions of AI's impact on learning reveals that a significant number believe AI contributes positively to education. The major benefits identified include improved learning outcomes, enhanced teacher efficiency, and reduced administrative workload. Many respondents observed that AI-powered adaptive learning significantly improves student comprehension by allowing learners to progress at their own pace, reducing failure rates, and enhancing academic performance. Additionally, AI assists teachers by automating tasks such as grading, student progress tracking, and lesson planning, enabling them to focus more on interactive teaching and mentorship, ultimately improving student-teacher engagement. While AI-driven administrative tools ranked lowest in preference, they were still recognized for their ability to streamline school operations, including attendance tracking, resource allocation, and communication management, thereby reducing paperwork and improving overall efficiency. These insights suggest that AI adoption in Nigerian schools should prioritize student-centred learning and teacher support while also exploring its role in optimizing administrative processes.

5.3 Challenges of AI Adoption in Nigerian Schools

Despite the perceived benefits of AI in education, the study identified several critical barriers to its adoption in Nigerian schools, with survey responses highlighting key challenges such as infrastructure limitations, lack of teacher training, and cost concerns. Infrastructure and connectivity issues emerged as a major obstacle, with unreliable electricity, poor internet access, and inadequate digital facilities restricting AI implementation, particularly in rural and underserved areas. Additionally, the shortage of AI-trained educators was cited as a significant barrier, as many teachers lack the necessary skills to integrate AI into their teaching methodologies, and professional development programs addressing this gap remain limited. Cost and sustainability concerns also pose a major challenge, as AI adoption requires substantial financial investment, making it difficult for low-income schools and government-funded institutions to afford AI-driven tools, software licensing, and ongoing maintenance. These findings suggest that overcoming these barriers will require strategic

investments in infrastructure, targeted teacher training initiatives, and sustainable funding models to ensure AI's successful integration into Nigeria's education system.

5.4 Proposed AI Integration Framework for Nigerian Schools

To address the challenges and maximize AI's benefits in education, this study proposes a structured AI integration framework for Nigerian schools, focusing on policy recommendations, training strategies, and sustainable implementation models. Policy recommendations include the development of a national AI education policy to support AI-driven teaching and learning, alongside fostering public-private partnerships to provide schools with essential infrastructure and funding. Training and capacity-building strategies emphasize the need for AI training programs to enhance teachers' digital literacy and proficiency, with schools encouraged to collaborate with universities, tech companies, and EdTech startups to offer hands-on AI workshops and certifications. For sustainable AI implementation, a phased adoption approach is recommended, starting with pilot programs in selected schools before national expansion. Additionally, the development of affordable AI-powered tools will help accommodate schools with limited budgets, while leveraging cloud-based AI solutions can reduce hardware costs and ensure scalability. By implementing this framework, Nigerian schools can effectively integrate AI into education, bridging the digital divide and enhancing learning outcomes.

6 Conclusion and Recommendations

This study has demonstrated the transformative potential of AI in Nigerian education while identifying key challenges that must be addressed for successful implementation. AI-powered personalized learning, automated assessment, and administrative support can significantly enhance learning outcomes, improve teacher efficiency, and streamline school operations. However, barriers such as inadequate infrastructure, lack of teacher training, and high implementation costs remain significant obstacles to widespread AI adoption. To overcome these challenges, a structured AI integration framework is essential. The government should develop a national AI education policy to support AI-driven teaching and learning, while public-private partnerships can provide the necessary infrastructure and funding. Teacher training programs should be prioritized to equip educators with AI skills, and collaborations with universities, tech companies, and EdTech startups can facilitate hands-on AI workshops. Sustainable AI implementation models should focus on phased adoption, affordable AI-powered tools, and cloud-based solutions to minimize costs and maximize scalability. Additionally, future research should explore the long-term impact of AI on student performance, the role of AI in inclusive education, and emerging AI trends that could further transform the educational landscape. By addressing these areas, Nigerian schools can harness AI's full potential, making education more adaptive, data-driven, and accessible to all learners.

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6.2 Competing Interests

The authors declared no conflict of interest for this study.

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