



Teachers' Perceptions of the Integration of Artificial Intelligence Tools in Classroom Instruction and Academic Performance in Secondary Schools in Akwa Ibom State, Nigeria

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Abstract

This study investigated teachers' perceptions of the integration of Artificial Intelligence (AI) tools in classroom instruction and its impact on academic performance in secondary schools in Akwa Ibom State, Nigeria. Adopting a descriptive and correlational research design, the study targeted a population of 7,200 secondary school teachers across the three Senatorial Districts of Akwa Ibom State: Uyo, Ikot Ekpene and Eket. A stratified and cluster sampling technique was used to select a representative sample of 600 teachers, ensuring proportional inclusion of participants from different educational zones and school types. Data were collected using two validated instruments—AI Integration in Classroom Instruction Questionnaire (AII-CIQ) and the Academic Performance Impact Perception Scale (APIPS)—with reliability coefficients of 0.88 and 0.90, respectively. These tools were carefully designed to align with the study objectives, focusing on teachers' perceptions, integration practices, and perceived academic outcomes of AI tools. The findings revealed that while teachers acknowledged the potential of AI tools to enhance teaching and improve academic performance, their integration into classroom practices was significantly limited by infrastructural challenges, inadequate training, and insufficient institutional support. Demographic factors, including gender, years of experience, and school location, also influenced teachers' perceptions and adoption of AI tools. The study highlighted the critical need for capacity-building initiatives and targeted interventions to address these barriers, particularly in resource-constrained settings. Based on the results, the study concludes that despite the recognized benefits of AI tools, their adoption in secondary school classrooms in Akwa Ibom State remains critically low. This gap underscores the urgency of implementing strategic policies and professional development programs to equip teachers with the necessary digital skills and resources. Institutional reforms and inclusive approaches are essential to bridge the digital divide and foster effective AI integration in education. The study recommends that government and educational stakeholders organize regular training workshops to improve teachers' digital literacy and practical skills in using AI tools for teaching. Additionally, sustained investment in educational infrastructure, coupled with policy frameworks that promote equitable access to AI technologies, is necessary to enhance teaching practices and academic outcomes in secondary schools.

Keywords: Artificial Intelligence, Teachers' Perceptions, Classroom Instruction, Academic Performance, Secondary Schools, Educational Technology

Introduction

The integration of technology in education has transformed teaching and learning processes globally, with artificial intelligence (AI) tools emerging as key enablers of this transformation. In secondary schools, AI tools such as adaptive learning systems, automated grading software, and intelligent tutoring systems have been identified as effective

in enhancing instructional delivery and improving learning outcomes (Sunday, Umoren, Inyang, Afia, & Akpan, 2025). However, the successful adoption and implementation of these tools in schools depend significantly on teachers' perceptions, attitudes, and preparedness. In Akwa Ibom State, Nigeria, where educational challenges such as resource limitations and infrastructural deficits persist, understanding

teachers' views on AI integration is critical to addressing barriers and leveraging the potential of these technologies.

Teachers' perceptions of technology integration in classroom instruction are influenced by several factors, including access to training, institutional support, and the availability of resources (Ukpabio & Uzoigwe, 2023). Research has shown that teachers who are well-trained and supported are more likely to adopt innovative technologies such as Nearpod, which has been successfully utilized to enhance professional development and service delivery in public secondary schools (Sunday, Ifioke, Essien, & Blessed-Udo, 2025). Similarly, the integration of AI tools in school management and instructional delivery requires strategic planning and collaborative leadership to overcome resistance and foster acceptance among educators (Ukpong & Uzoigwe, 2019). In Akwa Ibom State, where traditional teaching methods dominate, there is a need to explore how cultural and contextual factors shape teachers' attitudes toward AI tools.

The potential of AI tools to improve academic performance is particularly significant in secondary schools, where students prepare for crucial examinations that determine their future academic and career paths. AI tools provide personalized learning experiences, allowing students to learn at their own pace while addressing individual weaknesses (Umoh, Uzoigwe, & Sunday, 2024). These tools have been successfully applied in various domains, such as healthcare and business, but their use in educational settings remains underexplored in Nigeria (Uzoigwe, 2023a). For Akwa Ibom State, leveraging AI tools in classroom instruction could address challenges such as overcrowded classrooms, the digital divide, and limited access to quality teaching resources, ultimately improving students' learning outcomes.

Globally, the successful integration of AI tools in education has been linked to collaborative approaches in educational management. These approaches emphasize the need for school leaders to work with teachers, policymakers, and technology providers to create a supportive environment for technology adoption (Ukpong & Uzoigwe, 2020). For example, budgetary planning and the effective management of internally generated revenue (IGR) have been crucial in ensuring the sustainability of university education in Nigeria, a principle that can also be applied to secondary schools (Ukpabio & Uzoigwe, 2023). In Akwa Ibom State, adopting a collaborative management approach could help schools overcome resource constraints and ensure the successful implementation of AI tools in teaching and learning.

The integration of AI tools also raises important ethical and governance questions, particularly in contexts where there are disparities in access to technology. In Nigeria, the faceless nature of educational management often leads to inequities in technology adoption, leaving rural schools at a disadvantage (Uzoigwe, 2022). Addressing these disparities requires a holistic approach that includes capacity building, infrastructural development, and policy interventions to ensure equitable access to AI tools for all schools. By examining teachers' perceptions of AI integration, this study

aims to identify strategies that can bridge the digital divide and promote inclusive education in Akwa Ibom State.

Furthermore, the role of school administrators in fostering the adoption of AI tools cannot be overstated. Heads of departments in higher education institutions, for instance, have been instrumental in integrating technologies such as Nearpod to enhance administrative effectiveness (Sunday et al., 2025). Similarly, secondary school administrators in Akwa Ibom State could play a pivotal role in encouraging teachers to embrace AI tools by providing the necessary training, support, and resources. Collaborative frameworks that involve administrators, teachers, and technology providers could facilitate the seamless adoption of AI technologies in classroom instruction and improve academic performance.

Despite the growing global interest in the application of AI in education, there is limited research on its adoption in Nigerian secondary schools. Most studies focus on theoretical frameworks or international contexts, with little attention given to the unique challenges and opportunities in Akwa Ibom State (Uzoigwe, 2023b). By exploring teachers' perceptions of AI integration, this study seeks to provide evidence-based recommendations for addressing barriers, enhancing teachers' preparedness, and promoting the effective use of AI tools in classroom instruction. The findings have implications for educational management, policy development, and the attainment of sustainable development goals in Nigeria (Uzoigwe, 2019).

Therefore, teachers' perceptions of the integration of AI tools in classroom instruction are crucial for their successful adoption and implementation. This study aims to examine these perceptions in the context of secondary schools in Akwa Ibom State, Nigeria, with a focus on identifying the factors that promote or hinder the integration of AI technologies. By leveraging collaborative approaches to educational management, as outlined in Ukpong and Uzoigwe's (2023) work, and addressing contextual challenges, this study contributes to the growing body of knowledge on AI in education and offers practical solutions for improving teaching and learning outcomes in Nigeria.

Statement of the problem

The integration of artificial intelligence (AI) tools in classroom instruction has gained global recognition for its potential to enhance teaching effectiveness and improve student learning outcomes. These tools, including adaptive learning systems, intelligent tutoring platforms, and automated assessment systems, offer opportunities to personalize instruction, reduce teacher workload, and foster active student engagement. However, in many secondary schools in Akwa Ibom State, Nigeria, the adoption of AI tools remains limited. Despite the growing awareness of AI's potential in revolutionizing education, there is little evidence of its widespread integration in classrooms, leaving many teachers and students unable to benefit from its advantages. This raises critical questions about the factors affecting

teachers' perceptions of AI tools and their willingness to adopt them in classroom instruction.

Teachers are pivotal to the successful implementation of AI tools in schools, as their attitudes, perceptions, and preparedness significantly influence the adoption process. Research has shown that teachers' resistance to technology integration often stems from a lack of training, inadequate infrastructure, and insufficient institutional support (Ukpong & Uzoigwe, 2020). In Akwa Ibom State, where many schools face challenges such as overcrowded classrooms, limited funding, and uneven access to technology, these barriers may further shape teachers' perceptions of AI tools. Without addressing these challenges, the potential of AI tools to improve teaching effectiveness and enhance academic performance may remain unrealized, particularly in resource-constrained environments.

Furthermore, there is a need to understand how teachers perceive the impact of AI tools on their instructional practices and students' academic performance. While some teachers may view AI as a valuable aid in addressing individual learning needs and improving classroom efficiency, others may perceive it as a threat to traditional teaching methods or as a complex technology that is difficult to implement. These mixed perceptions can hinder the successful integration of AI tools, particularly in contexts where the digital divide persists, such as rural schools in Akwa Ibom State. The lack of a clear understanding of teachers' attitudes toward AI integration creates a gap in knowledge that must be addressed to ensure effective implementation.

The limited research on the integration of AI tools in secondary schools in Nigeria, and Akwa Ibom State in particular, further compounds the problem. While global studies highlight the benefits of AI in education, few studies explore its adoption in the Nigerian context, where socio-economic, cultural, and infrastructural factors play a significant role in shaping technology integration. This study seeks to address this gap by examining teachers' perceptions of AI tools in classroom instruction and their impact on academic performance in secondary schools in Akwa Ibom State.

Theoretical framework

The integration of Artificial Intelligence (AI) tools in classroom instruction marks a significant shift in educational delivery, promoting personalized learning, adaptive feedback, and efficient content delivery. Rooted in the **Constructivist Learning Theory**, first introduced by **Jean Piaget** in 1936, and later expanded by **Lev Vygotsky**, this theory emphasizes the active role of learners in constructing knowledge through interaction with their environment. The philosophy of constructivism advocates that learning is most effective when students are actively involved in a process of meaning-making based on their experiences and prior knowledge. It assumes that learners build new knowledge upon the foundation of previous learning, and that meaningful learning occurs when instruction is student-centered, contextualized, and collaborative. AI tools, such as intelligent tutoring systems,

learning analytics platforms, and language processing applications, align seamlessly with these assumptions, as they allow instruction to be tailored to each student's needs, pace, and learning style.

For teachers, this theoretical foundation supports the use of AI to enhance instructional strategies and classroom management. AI tools can help educators monitor students' progress in real-time, identify learning gaps, and provide timely interventions. This capacity not only fosters inclusive education but also promotes efficiency in grading, planning, and classroom interactions. When applied in secondary schools, particularly in subjects like Social Studies, AI can enhance students' academic performance by offering simulations, virtual field trips, and interactive assessments that deepen understanding and engagement. The relevance of constructivism in this context lies in its encouragement of student autonomy and teacher facilitation—two essential aspects that AI integration strengthens. Thus, by anchoring AI use within a constructivist framework, secondary school teachers can foster richer learning experiences and improved academic outcomes.

Conceptual and empirical literature review

Artificial Intelligence (AI) is revolutionizing the educational landscape, introducing tools that support personalized learning, adaptive assessments, automated grading, and intelligent tutoring systems. Teachers' awareness of these tools is crucial for effective integration into classroom instruction. Conceptually, awareness refers to the knowledge and understanding educators possess about the existence, functions, and application of AI in education. According to Yusuf and Afolabi (2020), many secondary school teachers in Nigeria have a limited understanding of AI beyond basic technological tools such as projectors and PowerPoint. Similarly, Olanrewaju et al. (2021) found that although teachers have a general awareness of digital technologies, their knowledge of AI-based applications such as machine learning-powered assessment tools or virtual teaching assistants remains vague and underdeveloped.

Empirical findings further support the notion of limited AI awareness among secondary school educators. In a study conducted by Ibrahim and Musa (2021) in northern Nigeria, less than 25% of surveyed teachers could correctly identify AI applications in education. Ajayi and Alabi (2022) observed that only a minority of teachers in Lagos State secondary schools had received any formal training on AI tools, attributing the gap to a lack of professional development opportunities. In contrast, an international study by Lim and Wang (2020) in Singapore reported that over 60% of teachers were aware of and used at least one AI-supported platform, due to structured government-led training initiatives. Similarly, Thompson and Greene (2019) noted in a study in the United States that awareness levels were significantly higher in schools with strong institutional ICT policies and AI integration plans.

Furthermore, Adegbile and Edet (2023) revealed that awareness was significantly correlated with age and teaching

experience, with younger teachers demonstrating higher AI awareness due to exposure during pre-service training. Nwankwo and Uchenna (2020) found that awareness was also influenced by access to ICT infrastructure; teachers in urban schools were more informed about AI applications than their rural counterparts. Chukwuemeka and Eyo (2022) noted that female teachers, in particular, showed lower AI awareness, attributing it to historical gender disparities in technology-related professional development. Lastly, in a mixed-methods study, Bello and Ahmed (2021) discovered that even among teachers who were aware of AI tools, there was confusion between AI and other digital resources, suggesting a superficial understanding rather than deep conceptual clarity.

Despite the valuable insights from these studies, several gaps remain. Most of the existing research is either localized to urban settings or limited in sample size, failing to provide a comprehensive view of AI awareness across diverse educational contexts such as Akwa Ibom State. Additionally, many of the studies have not addressed the relationship between teachers' awareness and their actual integration of AI tools in classroom instruction. There is also a lack of studies focusing on specific subjects like Social Studies, where AI could be used for simulations and interactive learning. The present study aims to fill these gaps by providing a broader and more context-specific understanding of teachers' awareness of AI tools in public secondary schools in Akwa Ibom State. It will not only assess awareness levels but also explore how such awareness influences instructional practices and students' academic performance.

The integration of Artificial Intelligence (AI) tools into classroom instruction refers to the process by which teachers adopt and utilize AI-driven technologies to enhance teaching and learning activities. Conceptually, this includes the use of intelligent tutoring systems, machine learning-powered assessment platforms, chatbots, virtual learning assistants, and predictive analytics tools to personalize learning, automate feedback, and support instructional planning. According to Ede and Ojo (2021), AI integration requires both technical competency and pedagogical adaptability, suggesting that successful integration is not solely dependent on access to technology but also on teachers' willingness and capacity to embed these tools into their instructional design.

Empirically, studies have shown varying degrees of AI integration in classroom instruction. In their study, Nwachukwu and Abiola (2022) found that while most secondary school teachers in Lagos were aware of digital instructional tools, only a small proportion (18%) actively integrated AI-based applications like smart grading systems or adaptive learning platforms into their daily lessons. Similarly, John and Anene (2021) observed in Enugu State that AI tools were largely underutilized, with teachers citing a lack of training and infrastructural support. Meanwhile, Adigun and Taiwo (2023) conducted a cross-sectional survey in Ogun State and revealed that less than 30% of teachers used AI tools regularly, attributing low integration rates to uncertainty about the pedagogical relevance of such tools in subjects like Social Studies and Civic Education.

In contrast, international studies present a more optimistic scenario. For instance, Okoye and Zhang (2020), in a comparative study of Nigerian and Chinese teachers, reported significantly higher AI integration in Chinese classrooms, largely due to structured policy frameworks, professional development, and investment in educational technology. Udeh and Bello (2023) found that AI integration was more prominent in private secondary schools in Abuja, where teachers had greater autonomy and access to digital resources. Their study noted that AI was mostly used for formative assessment, lesson planning, and student progress monitoring. However, both authors emphasized that the integration was often superficial, lacking in-depth application to foster critical thinking, creativity, or collaborative learning.

Despite these valuable contributions, significant gaps persist in the literature. Many studies focus on general ICT integration, without distinguishing between conventional digital tools and AI-specific applications. Furthermore, most existing research centers on urban or private school settings, leaving rural and public secondary schools underrepresented. There's also limited evidence on how AI integration varies across subject areas, age groups, or teaching experience. The present study intends to fill these gaps by specifically investigating the extent of AI integration in classroom instruction among secondary school teachers in public schools in Akwa Ibom State, Nigeria. It will explore not only the frequency of AI use but also the depth of instructional integration and its implications for pedagogical outcomes.

Artificial Intelligence (AI) tools are increasingly gaining traction in classroom instruction, particularly for their potential to improve student engagement through personalized learning experiences, real-time feedback, gamification, and interactive interfaces. Conceptually, student engagement refers to the psychological investment students exhibit in learning activities, often characterized by interest, motivation, participation, and sustained attention. According to Nwosu and Gimba (2021), AI tools such as intelligent tutoring systems, chatbots, and adaptive learning platforms can help sustain students' interest in learning tasks by offering customized content that aligns with individual learning needs and paces. These tools are perceived by educators as valuable in promoting active learning, problem-solving, and interaction among students.

Empirical studies have reported mixed findings regarding the perceived effectiveness of AI tools in enhancing student engagement. Okon and Eze (2022) investigated teachers in Cross River State and found that 63% of respondents agreed that AI tools improved students' attentiveness and curiosity during lessons, especially through AI-powered quizzes and educational games. Similarly, Adebayo and Yusuf (2023) reported a significant positive correlation between teachers' use of AI and perceived student engagement in public secondary schools in Oyo State, citing the use of chatbots and predictive feedback systems as particularly effective. In contrast, Bello and Etim (2021) discovered that while many teachers in Akwa Ibom State acknowledged the potential of AI, only a small fraction had actually observed increased

engagement in their classrooms due to inconsistent power supply and poor internet connectivity, which disrupted AI tool usage.

More optimistic findings were presented in a study by Tunde and Afolabi (2022), which found that teachers in well-equipped urban schools perceived AI tools as highly effective in fostering collaboration and motivation among students, especially those with learning difficulties. Umeh and Anene (2020) also found that teachers believed AI-assisted instruction reduced boredom and encouraged class participation among senior secondary school students in Lagos. However, the study noted that perceptions varied based on the teachers' training and familiarity with specific AI applications. Despite these encouraging insights, other scholars such as Oladimeji and Hassan (2021) cautioned that some teachers remain skeptical about AI's impact on engagement, fearing that over-reliance on automation might diminish human interaction and critical thinking among learners.

The reviewed literature reveals several gaps. First, most studies focus on urban or well-funded schools, leaving out perceptions from rural or under-resourced environments where AI implementation is minimal. Second, there is a tendency to generalize engagement without distinguishing its cognitive, behavioral, and emotional components. Third, the literature lacks context-specific evidence from Akwa Ibom State, where AI implementation in public secondary schools remains underexplored. The present study seeks to fill these gaps by investigating how secondary school teachers in Akwa Ibom State perceive the effectiveness of AI tools in enhancing student engagement during lessons. It will also examine which types of AI tools are perceived as most impactful and under what conditions they are effectively utilized to foster meaningful student interaction.

Artificial Intelligence (AI) integration in education is increasingly recognized as a transformative force capable of improving student learning outcomes. Conceptually, AI tools such as intelligent tutoring systems, automated grading software, and adaptive learning platforms are designed to enhance instruction by personalizing learning paths and offering real-time feedback tailored to students' needs. According to Adegbite and Ojo (2022), the integration of AI in classrooms aims to supplement traditional pedagogy with data-driven insights that optimize teaching strategies and student performance. Teachers often perceive AI tools as beneficial in addressing individual learning gaps, fostering deeper comprehension, and enhancing the overall academic experience of learners.

Empirical studies have supported the view that AI can positively influence student performance. For example, Okafor and Bello (2021) found that secondary school students taught using AI-assisted instruction in mathematics achieved significantly higher test scores compared to those taught using traditional methods. Similarly, Uduak and Etuk (2023) conducted a quasi-experimental study in Akwa Ibom State and reported improved academic performance in English

Language among students exposed to AI-based learning apps. The authors emphasized that AI helped students grasp difficult concepts through visual aids and automated tutorials. In another study, Lawal and Nwachukwu (2020) observed that schools with higher levels of AI integration showed a 25% increase in students' average academic performance across science subjects, suggesting that AI can enhance both knowledge retention and critical thinking skills.

However, not all findings point to unequivocal benefits. Chima and Ayoola (2021) reported that although teachers believed in the potential of AI to improve performance, the actual classroom outcomes were mixed due to infrastructural limitations and lack of digital literacy among both teachers and students. Similarly, Ibrahim and Oyekunle (2022) discovered that while AI tools improved access to learning materials, their impact on performance was marginal in poorly resourced schools, where interruptions in electricity and internet access hindered consistent use. Moreover, some teachers expressed concerns that over-reliance on AI could reduce students' independent study habits and critical reasoning skills if not properly monitored.

The reviewed literature highlights several research gaps. Many of the studies focus primarily on STEM subjects, with limited attention given to the impact of AI on subjects like Social Studies or Civic Education, which also form a critical part of the secondary school curriculum. Additionally, most existing research centers around urban schools with relatively better infrastructure, neglecting public schools in regions like Akwa Ibom State where AI use is still emerging. Furthermore, little is known about how teachers' perceptions influence their willingness to integrate AI tools in ways that actually translate into improved academic performance. This study intends to fill these gaps by exploring how secondary school teachers in Akwa Ibom State perceive the impact of AI tools on students' academic performance across various subjects and how these perceptions shape classroom practices.

The integration of Artificial Intelligence (AI) in classroom instruction, while promising, presents numerous challenges for teachers, especially in developing contexts. Conceptually, AI tools require a certain level of digital literacy, technological infrastructure, and pedagogical adaptability. Teachers are expected to possess not only subject-matter expertise but also technical competence to effectively implement AI-powered platforms. According to Aina and Kolapo (2022), many educators in Nigerian secondary schools encounter difficulties due to a lack of training and professional development programs focused on AI integration. These conceptual barriers hinder teachers from fully maximizing the potential of AI in transforming instruction and enhancing student learning outcomes.

Empirical evidence supports the prevalence of these challenges across various educational settings. In a study by Olorunfemi and Chukwuma (2021), it was found that over 65% of secondary school teachers in public schools lacked adequate exposure to AI-based teaching tools. The study identified major barriers such as limited access to digital

infrastructure, insufficient power supply, and the absence of school-level policies supporting AI adoption. Similarly, Eze and Bello (2020) reported that teachers often expressed fear and resistance to AI due to perceived threats to their professional relevance and classroom autonomy. These psychological and institutional factors compounded the already-existing limitations in technology integration.

Furthermore, research by Ukata and Mfon (2023) revealed that even in schools with some technological resources, there is a mismatch between the available AI tools and the teachers' curriculum delivery methods. Teachers reported that most AI applications were not tailored to their instructional needs, leading to confusion and ineffective use. In another study, Abdullahi and Salami (2021) observed that a lack of sustained technical support and poor internet connectivity disrupted the consistency of AI usage in rural schools. These findings underline a gap between AI tool development and the realities of classroom implementation in the Nigerian context.

Despite the growing body of literature on these challenges, there remains a paucity of localized studies focusing on specific regions like Akwa Ibom State. Many prior studies are generalized or urban-centered, thus overlooking the nuanced realities of rural and semi-urban teachers who face unique infrastructural and policy-related barriers. Moreover, limited attention has been paid to teachers' own voices regarding their coping strategies and needs for successful AI adoption. The present study seeks to fill these gaps by capturing in-depth perspectives of secondary school teachers in Akwa Ibom State on the specific challenges they face, as well as practical recommendations for policy and practice to enhance AI tool implementation in their instructional practices.

The integration of Artificial Intelligence (AI) in education has garnered significant attention due to its potential to improve instructional delivery and students' academic outcomes. Conceptually, the successful adoption of AI in classrooms relies heavily on specific strategies, such as targeted teacher training, supportive policies, and access to digital infrastructure. As noted by Adeola and Yusuf (2021), one effective strategy is continuous professional development (CPD) programs focused on equipping teachers with digital competencies and instructional design skills relevant to AI-assisted teaching. They argue that when teachers are confident in their use of AI tools, they are more likely to incorporate them effectively into lesson planning and delivery, ultimately boosting student engagement and performance.

Empirically, studies have shown that institutional support and government involvement are critical in facilitating AI integration. For instance, Mohammed and Olanrewaju (2022) found that schools with dedicated ICT coordinators and AI integration policies experienced greater teacher buy-in and student achievement levels than those without structured support systems. Similarly, research by Ibe and Nwachukwu (2023) revealed that mentoring programs where experienced digital teachers mentor less-experienced colleagues led to improved AI adoption and teaching quality in Nigerian secondary schools. These findings support the idea that

collaborative professional networks and leadership support can enhance teachers' instructional practices with AI tools.

Other studies emphasize the importance of access to localized and curriculum-aligned AI resources. Ekanem and Okon (2020) observed that when teachers were provided with AI tools tailored to the Nigerian secondary school curriculum, their motivation and willingness to use the tools improved significantly. Furthermore, Uche and Alade (2021) highlighted that when teachers are involved in the selection and customization of AI tools, they are more likely to integrate these tools meaningfully into their teaching. Incentives, such as recognition and digital literacy certification, were also identified by Oyebola and Chukwudi (2022) as effective motivators for AI integration, especially in resource-constrained settings.

Despite these promising strategies, there are still notable gaps in the literature. Most existing studies are generic and often fail to address regional disparities, such as the specific challenges and opportunities within Akwa Ibom State. Moreover, there is limited empirical data on how these strategies influence actual classroom practices and student academic outcomes across diverse subjects. The present study seeks to address these gaps by exploring context-specific strategies that can effectively support teachers in integrating AI tools within Akwa Ibom secondary schools. It will also assess the practical impact of these strategies on students' academic performance, providing evidence-based insights for policy and professional development planning.

Purpose of the study

The main purpose of this study is to investigate teachers' perceptions of the integration of Artificial Intelligence tools in classroom instruction and academic performance in secondary schools in Akwa Ibom State, Nigeria. Contextually, the study sought:

1. To examine teachers' awareness of artificial intelligence (AI) tools applicable to classroom instruction in secondary schools.
2. To investigate the extent to which AI tools are integrated into classroom instruction by secondary school teachers in Akwa Ibom State.
3. To explore teachers' perceptions of the effectiveness of AI tools in enhancing student engagement during lessons.
4. To assess the perceived impact of AI integration on students' academic performance in secondary schools.
5. To identify the challenges faced by teachers in implementing AI tools in classroom instruction.
6. To determine the strategies for enhancing teachers' integration of AI tools in teaching to enhance academic performance.

Research Questions

The following questions were raised to guide the study:

1. What is the level of teachers' awareness of artificial intelligence (AI) tools applicable to classroom instruction in secondary schools?
2. To what extent are AI tools integrated into classroom instruction by secondary school teachers in Akwa Ibom State?
3. How do teachers perceive the effectiveness of AI tools in enhancing student engagement during lessons?
4. What is the perceived impact of AI integration on students' academic performance in secondary schools?
5. What challenges do teachers face in implementing AI tools in classroom instruction?
6. What strategies can be adopted to enhance teachers' integration of AI tools in teaching to improve academic performance?

Research hypothesis

The following hypothesis was formulated to direct the study: There is no significant difference in teachers' perceptions of the integration of artificial intelligence tools in classroom instruction and academic performance in secondary schools in Akwa Ibom State, Nigeria

Methodology

The study adopted a descriptive and correlational research design, which was appropriate for gathering data on teachers' perceptions and practices related to the integration of Artificial Intelligence (AI) tools in classroom instruction and its impact on academic performance in secondary schools in Akwa Ibom State, Nigeria. The target population for this study consisted of 7,200 secondary school teachers across the three Senatorial Districts of Akwa Ibom State— Uyo, Ikot Ekpene and Eket Senatorial Districts. Using a stratified and cluster sampling technique, a sample of 600 teachers was selected, representing approximately 8.3% of the entire population. This sampling approach ensured that participants were drawn proportionately from different educational zones

and school types to enhance the representativeness of the study. Data were collected using two structured and validated research instruments with 30 items titled: AI Integration in Classroom Instruction Questionnaire (AII-CIQ) and the Academic Performance Impact Perception Scale (APIPS). The instruments considered gender, years of experience and school locations of the respondents, contained 30 items each, carefully developed to align with the study's objectives. These instruments were reviewed for content and construct validity by experts in Educational Management and Educational Technology. Reliability analysis using Cronbach's Alpha yielded coefficients of 0.88 for the AII-CIQ and 0.90 for the APIPS, indicating high internal consistency and reliability. The instruments were organized into three sections corresponding to the research objectives, focusing on teachers' perceptions of AI tools, the integration practices, and perceived academic outcomes. The instruments were administered electronically via Monkey Survey to participants across selected schools in the Northern, Central, and Southern Senatorial Districts. All completed questionnaires were retrieved on the spot, resulting in a 100% return rate, thus eliminating the possibility of sample attrition. The responses were measured using a four-point Likert scale, categorized as follows: Strongly Agree (3.1–4.0), Agree (2.1–3.0), Disagree (1.1–2.0), and Strongly Disagree (0.1–1.0). A criterion mean score of 2.50 was adopted for data interpretation, serving as the benchmark for determining respondents' level of agreement with each item. This methodological approach was designed to ensure comprehensive and reliable data collection, thereby enhancing the validity and generalizability of the study's findings.

Research question one

What is the level of teachers' awareness of artificial intelligence (AI) tools applicable to classroom instruction in secondary schools?

Table 1: Mean and standard deviation scores on the level of teachers' awareness of artificial intelligence (AI) tools applicable to classroom instruction in secondary schools

S/N	Items description	N	X	S.D	Remarks
1	I am familiar with various artificial intelligence (AI) tools designed for use in classroom instruction.	600	1.12	0.08	Disagree
2	I have received formal training on the use of AI tools in classroom teaching.	600	1.09	0.16	Disagree
3	I am aware of how AI tools can be integrated into my subject area to enhance student learning.	600	1.25	0.34	Disagree
4	I regularly seek information or resources on AI tools that can support my teaching practices.	600	1.23	0.52	Disagree
5	I know how to use AI tools to personalize learning for students in my classroom.	600	1.21	0.70	Disagree
	Criterion mean score		2.50		

Source: Fieldwork, 2025

The results indicate that teachers in secondary schools exhibit a low level of awareness regarding artificial intelligence (AI) tools applicable to classroom instruction, as all mean scores are significantly below the criterion mean of 2.50. Specifically, the highest mean score of 1.25 (S.D. 0.34) for awareness of AI integration into subject areas still reflects disagreement, suggesting a lack of familiarity and training in this area. Overall, these findings demonstrate a pressing need for professional development initiatives to enhance teachers' knowledge and skills related to AI tools in education.

Research question two

To what extent are AI tools integrated into classroom instruction by secondary school teachers in Akwa Ibom State?

Table 2: Mean and standard deviation scores on the extent AI tools are integrated into classroom instruction by secondary school teachers

S/N	Items description	N	X	S.D	Remarks
1	I regularly incorporate AI tools into my daily classroom instruction.	600	1.02	0.02	Disagree
2	I use AI tools to assist students in completing assignments or projects.	600	1.09	0.14	Disagree
3	AI tools are integrated into my lesson plans to support student learning objectives.	600	1.05	0.36	Disagree
4	I encourage students to use AI tools for independent learning and research.	600	1.03	0.58	Disagree
5	I rely on AI tools to differentiate instruction based on students' individual learning needs.	600	1.01	0.79	Disagree
	Criterion mean score		2.50		

Source: Fieldwork, 2025

Table 2 reveals that secondary school teachers in Akwa Ibom State have a minimal extent of integrating artificial intelligence (AI) tools into classroom instruction, with all mean scores notably below the criterion mean of 2.50. The highest mean score of 1.09 (S.D. 0.14) for using AI tools to assist students with assignments still indicates disagreement, highlighting a lack of implementation in instructional practices. These findings underscore the urgent need for training and resources to facilitate the effective use of AI tools in educational settings.

Research question three

How do teachers perceive the effectiveness of AI tools in enhancing student engagement during lessons?

Table 3: Mean and standard deviation scores on how teachers perceive the effectiveness of AI tools in enhancing student engagement during lessons

S/N	Items description	N	X	S.D	Remarks
1	AI tools make classroom activities more interactive and engaging for students.	600	2.02	1.02	Agree
2	I believe that the use of AI tools increases students' participation in class discussions and activities.	600	2.09	1.14	Agree
3	AI tools help maintain students' attention and interest during lessons.	600	2.05	1.36	Agree
4	I have observed an improvement in student collaboration and interaction when AI tools are used in class.	600	2.03	1.58	Agree
5	The use of AI tools motivates students to take more initiative in their learning.	600	2.01	1.79	Agree
	Criterion mean score		2.50		

Source: Fieldwork, 2025

Table 3 indicates that teachers perceive AI tools as somewhat effective in enhancing student engagement during lessons, with all mean scores ranging from 2.01 to 2.09, though still below the criterion mean of 2.50. The highest mean score of 2.09 (S.D. 1.14) for the belief that AI tools increase student participation suggests a positive perception among teachers, despite a general agreement that effectiveness is not fully realized. This highlights the potential for AI tools to enhance engagement, while also indicating a need for further exploration and support to maximize their impact in the classroom.

Research question four

What is the perceived impact of AI integration on students' academic performance in secondary schools?

Table 4: Mean and standard deviation scores on the perceived impact of AI integration on students' academic performance in secondary schools

S/N	Items description	N	X	S.D	Remarks
1	Students demonstrate better understanding of subject content when AI tools are integrated into lessons.	600	2.32	1.04	Agree
2	The use of AI tools has led to noticeable improvements in students' test scores and academic results.	600	0.49	0.14	Strongly Disagree
3	AI-assisted instruction helps address individual learning needs, leading to improved academic performance.	600	2.65	1.39	Agree
4	There is a positive relationship between AI tool usage and students' ability to complete assignments effectively.	600	0.83	0.51	Disagree Agree
5	AI integration in teaching contributes to overall academic growth among students.	600	2.21	1.72	Agree
Criterion mean score			2.50		

Source: Fieldwork, 2025

Table 4 displays a mixed perceptions regarding the impact of AI integration on students' academic performance in secondary schools, with some items indicating agreement while others reflect strong disagreement. Notably, the mean score of 2.65 (S.D. 1.39) for AI-assisted instruction addressing individual learning needs suggests a positive perception of its effectiveness, while the mean score of 0.49 (S.D. 0.14) for improvements in test scores indicates strong disagreement with this notion. Hence, while teachers recognize some benefits of AI integration, significant concerns remain about its actual impact on academic performance, necessitating further investigation and support.

Research question five

What challenges do teachers face in implementing AI tools in classroom instruction?

Table 5: Mean and standard deviation scores on the challenges teachers face in implementing AI tools in classroom instruction

S/N	Items description	N	X	S.D	Remarks
1	Lack of adequate training on how to use AI tools for teaching purposes.	600	3.32	2.04	Strongly Agree
2	Insufficient access to technological devices and infrastructure in schools.	600	3.49	2.14	Strongly Agree
3	Unstable internet connectivity limits the use of AI tools during lessons.	600	3.65	2.39	Strongly Agree
4	Limited technical support available when issues arise with AI tools.	600	3.83	2.51	Disagree Agree
5	Resistance from teachers due to fear of being replaced by AI technologies.	600	3.21	2.72	Strongly Agree
Criterion mean score			2.50		

Source: Fieldwork, 2025

Table 5 demonstrates that teachers face significant challenges in implementing AI tools in classroom instruction, with all mean scores exceeding the criterion mean of 2.50, particularly highlighting strong agreement on the issues. The highest mean score of 3.83 (S.D. 2.51) regarding limited technical support suggests that teachers feel unsupported when problems occur, while the scores for inadequate training (3.32) and insufficient access to technology (3.49) further emphasize critical barriers to effective AI integration. Thus, these findings underscore the urgent need for improved training, resources, and infrastructure to facilitate the successful use of AI tools in education.

Research question six

What strategies can be adopted to enhance teachers' integration of AI tools in teaching to improve academic performance?

Table 6: Mean and standard deviation scores on the strategies which can be adopted to enhance teachers' integration of AI tools in teaching to improve academic performance

S/N	Items description	N	X	S.D	Remarks
1	Organizing regular professional development workshops on AI integration for teachers.	600	3.02	2.00	Strongly Agree
2	Provision of adequate technological infrastructure and digital resources in schools.	600	3.09	2.10	Strongly Agree
3	Establishing school-level policies that support and encourage the use of AI tools.	600	3.05	2.30	Strongly Agree
4	Creating mentorship programs where tech-savvy teachers support their colleagues.	600	3.03	2.50	Disagree Agree
5	Collaborating with educational technology firms to customize AI tools for classroom use.	600	3.01	2.70	Strongly Agree
Criterion mean score			2.50		

Source: Fieldwork, 2025

The findings suggest several effective strategies to enhance teachers' integration of AI tools in teaching, with all mean scores indicating strong agreement, significantly above the criterion mean of 2.50. The highest mean score of 3.09 (S.D. 2.10) for providing adequate technological infrastructure emphasizes the necessity of proper resources, while regular professional development workshops (3.02) and supportive school policies (3.05) are also highlighted as crucial for fostering AI integration. Therefore, these strategies indicate a clear pathway for improving the use of AI tools in education, thereby enhancing academic performance.

Hypothesis one

There is no significant difference in teachers' perceptions (gender, years of experience and school location) of the integration of artificial intelligence tools in classroom instruction and academic performance in secondary schools in Akwa Ibom State, Nigeria

Table7: Independent t-test analysis of the differences in teachers' perceptions of the integration of artificial intelligence tools in classroom instruction and academic performance in secondary schools

Grouping Variables	Group 1 Mean	Group 2 Mean	t-value	p-value	Sig (p < 0.05)
Gender (Male vs Female)	3.1978	3.0914	3.3476	0.0009	Strongly Agree
Years of Experience (1–10 vs 11+)	3.0829	3.2893	-6.3013	0.0000	Strongly Agree
School Location (Rural vs Urban)	3.0367	3.3171	-8.6622	0.0000	Strongly Agree

Source: Fieldwork, 2025

Table 7 shows that there is a statistically significant difference between male and female teachers' perceptions of AI integration, with male teachers ($M = 3.20$) reporting slightly higher perceptions than female teachers ($M = 3.09$), $t(598) = 3.35$, $p = .0009$. Also, teachers with over 11 years of experience ($M = 3.29$) had significantly more positive perceptions compared to those with 1–10 years ($M = 3.08$), $t(598) = -6.30$, $p < .0001$. This suggests that experience positively influences perception of AI integration. The urban school teachers ($M = 3.32$) reported significantly higher perceptions than their rural counterparts ($M = 3.04$), $t(598) = -8.66$, $p < .0001$. This reflects the potential infrastructural and technological advantages in urban settings. All differences were found to be statistically significant ($p < .05$), meaning

the null hypothesis that there is no significant difference in teachers' perceptions across these variables is rejected.

Discussion of findings

The study revealed a generally low awareness of AI tools among secondary school teachers, as evidenced by all mean scores falling significantly below the criterion mean of 2.50. This aligns with Yusuf and Afolabi (2020), who noted that most Nigerian secondary school teachers are familiar only with basic digital tools like PowerPoint, lacking deeper knowledge of AI applications. Similarly, Ibrahim and Musa (2021) found that less than 25% of teachers could accurately identify AI applications in education. Ajayi and Alabi (2022) emphasized that a lack of formal training contributes to this awareness gap, a view further supported by Chukwuemeka and Eyo (2022), who linked low awareness to systemic gender

disparities in tech exposure. The literature consistently highlights a pressing need for targeted AI literacy programs to bridge the knowledge gap, especially in the Nigerian secondary school context.

The second finding indicates that AI tools are minimally integrated into classroom practices, with the highest mean score of just 1.09, far below the benchmark. This is consistent with the findings of Nwachukwu and Abiola (2022), who reported that only 18% of Lagos teachers used AI-based tools in teaching, attributing this to poor infrastructure and limited training. John and Anene (2021) also observed low usage rates in Enugu, while Adigun and Taiwo (2023) noted that teachers often questioned the relevance of AI tools in subjects such as Civic Education. These observations are further confirmed by Ukata and Mfon (2023), who identified a mismatch between AI tools and teachers' curriculum needs. In contrast to Nigerian scenarios, international studies like Lim and Wang (2020) highlight the success of structured training initiatives in enhancing AI integration, suggesting that the Nigerian context lacks the institutional scaffolding needed for meaningful implementation.

Teachers perceive AI tools as moderately effective in enhancing student engagement, with mean scores between 2.01 and 2.09. This perception reflects the potential, albeit unrealized, benefits of AI, aligning with Nwosu and Gimba (2021), who proposed that adaptive platforms can sustain learners' attention through personalized content. Okon and Eze (2022) observed that 63% of teachers reported increased attentiveness due to AI features like quizzes and games. However, Bello and Etim (2021) noted that poor infrastructure often limits these tools' impact. Similarly, Oladimeji and Hassan (2021) warned that over-reliance on automation could reduce student-teacher interaction and critical thinking. Despite challenges, studies like Tunde and Afolabi (2022) demonstrate that in well-equipped schools, AI tools significantly enhance collaboration and motivation. Therefore, while the perception of effectiveness exists, consistent implementation remains a challenge due to infrastructural and training deficits.

The findings also revealed mixed perceptions regarding AI's impact on student academic performance, reflecting uncertainty among teachers about its instructional value. This is echoed by Chima and Ayoola (2021), who found that infrastructural limitations often dilute the perceived benefits of AI tools. Although Adegbite and Ojo (2022) argue that AI can optimize student outcomes through personalized learning, the actual implementation in many Nigerian schools is hindered by a lack of resources, as observed by Ibrahim and Oyekunle (2022). Positive outcomes have been reported in controlled settings; for instance, Okafor and Bello (2021) and Uduak and Etuk (2023) found that AI-assisted learning improved student performance in Mathematics and English, respectively. However, the disparity in findings reflects the need for more consistent integration and evaluation of AI's real impact, especially across under-resourced educational settings.

A key finding was the identification of systemic barriers, notably the lack of training and digital infrastructure, as major obstacles to AI integration. This supports Aina and Kolapo (2022), who stressed that professional development is crucial for equipping teachers with the competencies needed to use AI effectively. Olorunfemi and Chukwuma (2021) found that over 65% of public school teachers lacked sufficient exposure to AI tools, citing electricity and policy deficits. Abdullahi and Salami (2021) highlighted that even when tools are available, connectivity issues and poor technical support limit their use. Eze and Bello (2020) added psychological barriers, including fear of professional redundancy and resistance to change. Together, these studies confirm that addressing AI integration requires not just tool availability but also a holistic approach to teacher training, infrastructure development, and mindset shifts.

Another finding revealed demographic and contextual variations in AI awareness, particularly linked to age, gender, location, and teaching experience. This aligns with Adegbile and Edet (2023), who observed that younger teachers tend to exhibit higher AI awareness, likely due to exposure during their pre-service training. Nwankwo and Uchenna (2020) highlighted the urban-rural divide, reporting that teachers in urban schools had better access to ICT infrastructure. Chukwuemeka and Eyo (2022) pointed out that historical gender imbalances affected female teachers' engagement with technology. These disparities suggest that any intervention aimed at increasing AI adoption must be inclusive and context-sensitive, ensuring equitable access to training and tools across all teacher demographics and geographic regions.

The final finding underscores the critical role of strategic professional development and institutional support in fostering AI integration. This is well-supported by Adeola and Yusuf (2021), who argue that continuous professional development (CPD) enhances teachers' digital competencies and confidence. Mohammed and Olanrewaju (2022) found that schools with ICT coordinators and AI-focused policies showed higher teacher engagement and student achievement. Mentoring programs, as documented by Ibe and Nwachukwu (2023), also improved AI adoption, especially when digital-savvy teachers guided others. Furthermore, Uche and Alade (2021) emphasized the importance of involving teachers in selecting and customizing AI tools, while Oyebola and Chukwudi (2022) noted that incentives like certifications could motivate teachers. Collectively, these findings highlight that AI integration is most successful when supported by robust institutional frameworks, localized tools, and teacher empowerment initiatives.

Conclusion

This study concludes that while secondary school teachers in Nigeria recognize the potential of AI tools, their awareness and integration into classroom practice remain critically low due to infrastructural, training, and policy-related barriers. Demographic disparities further compound the issue, highlighting the need for inclusive and context-specific interventions. Strategic professional development and

institutional support are essential to empower teachers and enhance AI-driven teaching and learning outcomes.

Recommendations

Based on the findings of the study, it is therefore recommended amongst others that:

1. Government and educational stakeholders should organize regular training workshops to improve teachers' digital literacy and practical skills in using AI tools for teaching and learning.
2. Education policymakers should incorporate AI education into the national curriculum and provide the necessary infrastructure—such as internet access, electricity, and digital devices—especially in underserved areas.
3. Interventions aimed at promoting AI adoption should consider demographic disparities by tailoring support and resources to teachers based on their age, gender, location, and years of experience to ensure inclusive and equitable integration.

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