



IMPACT OF ARTIFICIAL INTELLIGENCE (AI) TOOLS ON TEACHING EFFECTIVENESS IN SENIOR SECONDARY SCHOOLS IN GOMBE STATE

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Abstract

This study examines the influence of Artificial Intelligence (AI) tools on teaching effectiveness in senior secondary schools in Gombe State, that examines the Impact of AI Tools on Teaching Effectiveness in Senior Secondary Schools in Gombe State. The study adopted a descriptive survey research design. Population of the study was 1,410 Secondary School Teachers in Gombe State Nigeria, one hundred and seventy-five (175) teachers were used as sample. Data were collected using a structured questionnaire titled "AI in Education Assessment Scale (AIEAS)". Mean and standard deviation were used to answer the research questions. The reliability of the instrument was established by testing the internal consistency of the items using Cronbach alpha with coefficients ranging from .758 to .879, indicating sufficient internal consistency, the research explored how AI driven educational technologies support lesson delivery, student engagement, assessment, and overall instructional quality. Findings reveal that AI tools significantly improve teachers' efficiency, enhance personalized learning, and promote data-driven instructional decisions. However, challenges such as limited digital literacy, inadequate infrastructure, and inconsistent internet access hinder optimal utilization. Recommendations include teacher capacity building, infrastructure development, and supportive policy frameworks.

Keywords: Artificial Intelligence, Teaching Effectiveness, Secondary Schools, Gombe State.



Introduction

Teaching effectiveness is a critical determinant of students' academic success, particularly in senior secondary schools where learners prepare for higher education and national examinations. The advent of Artificial Intelligence (AI) has introduced transformative opportunities for education worldwide, with tools such as intelligent tutoring systems, automated grading software, adaptive learning platforms, and chatbots assist teachers in lesson delivery and assessment. In Gombe State, where many schools face constraints such as large class sizes and limited instructional resources, AI tools have the potential to strengthen pedagogical outcomes. Luckin, Holmes, Griffiths, & Forcier (2016) provide a foundational overview of AI in education, arguing that effective implementation depends on aligning AI capabilities with precise pedagogical goals and robust teacher professional development. In the context of Nigerian secondary schools, where large class sizes and limited instructional resources are common challenges, AI tools hold promise in bridging resource gaps, improving teacher efficiency, and enhancing the overall quality of education. However, successful integration requires adequate infrastructure, teacher training, and supportive policies (Afolabi & Akinola, 2023).

Afolabi and Akinola (2023) investigated AI integration in Nigerian secondary education and found that AI tools improved assessment efficiency and student-centered learning. Similarly, Omodan (2022) revealed that teachers in Sub-Saharan Africa acknowledged the potential of AI for classroom engagement, although infrastructural challenges remained a barrier. In a study by Bello and Musa (2021), teachers reported that AI-based applications enhanced lesson planning and real-time feedback, which contributed to

higher student participation. Ogunleye (2020) observed that intelligent tutoring systems significantly improved students' performance in mathematics, thereby supporting teachers' instructional delivery. Lin et al. (2019) examined Chinese high schools and discovered that AI-powered adaptive learning platforms fostered personalized learning and improved knowledge retention. Eze and Okonkwo (2021) studied secondary schools in Enugu State and found that AI-based educational platforms facilitated continuous assessment and reduced teachers' workload. Further, Olalekan (2022) reported that AI chatbots assisted teachers in administrative tasks, leaving more time for creative lesson planning. Adebayo and Salihu (2020) highlighted that AI-supported grading systems minimized human error in assessment, thus improving transparency. Internationally, Holmes et al. (2020) demonstrated that AI improved teaching efficiency across multiple contexts by supporting collaborative learning. Likewise, UNESCO (2021) stressed the transformative role of AI in reshaping pedagogy through adaptive and inclusive technologies. Collectively, these studies indicate that AI tools enhance teaching effectiveness by improving lesson delivery, facilitating personalized learning, and streamlining assessment, although challenges related to infrastructure, training, and policy persist.

The Nature of AI Tools in Education Artificial Intelligence (AI) in the educational sector refers to computer-based systems designed to simulate human cognitive functions such as reasoning, problem-solving, and learning to support pedagogical goals (Adebayo & Salihu, 2020). These technologies encompass a broad spectrum of applications, including adaptive learning platforms, automated grading systems, intelligent tutoring systems (ITS), and generative AI like



ChatGPT and Google Gemini (Afolabi & Akinola, 2023). According to Holmes, Bialik, and Fadel (2020), the primary function of these tools is to personalize instruction and provide real-time feedback, effectively transforming the teacher's role from a primary information source to a facilitator of technology-enhanced learning.

Defining Teaching Effectiveness in the Digital Age Teaching effectiveness is a multifaceted construct defined by a teacher's ability to facilitate meaningful learning, improve student comprehension, and achieve specific educational outcomes (Darling-Hammond, 2017). It involves not only content delivery but also lesson planning, classroom management, and the ability to adapt instruction to diverse learner needs. In this study, effectiveness is viewed through the lens of how AI complements these competencies—specifically by automating repetitive administrative tasks like grading and attendance, thereby "unfreezing" time for teachers to engage in high-value instructional planning and one-on-one student mentorship (Luckin et al., 2016). Contextual Considerations for Gombe State Despite these benefits, the impact of AI on teaching effectiveness is not automatic; it is filtered through "institutional cultures, teacher beliefs, and infrastructure" (Selwyn, 2019). In the context of North-Central Nigeria, factors such as digital competence, data costs, and device availability play a decisive role in whether AI tools successfully improve outcomes or remain underutilized (Adewale & Musa, 2024). For senior secondary schools in Gombe State, the concept of AI-enhanced effectiveness revolves around using intelligent systems to manage large class sizes and improve instructional quality while navigating these local infrastructural constraints.

Objectives of the Study

The main objective of this study is to examine the Impact of AI Tools on Teaching Effectiveness in Senior Secondary Schools in Gombe State. Specifically, the study sought to:

1. To assess the extent of Artificial Intelligence tools adoption among senior secondary school teachers in Gombe State.
2. To examine the influence of Artificial Intelligence tools on lesson delivery and classroom management.
3. To determine how Artificial Intelligence tools influence student engagement and personalized learning.
4. To identify challenges faced by teachers in integrating Artificial Intelligence tools into teaching.

Methodology

The study adopted a descriptive survey design. According to Creswell (2018), survey research involves selecting a sample from a population, administering a survey instrument, and collecting and analyzing responses to gather information about attitudes, opinions, behaviors, or characteristics. This approach allows for the systematic investigation of a specific population or phenomenon, often utilizing quantitative data analysis techniques. The population consisted of 1410 senior secondary school teachers across selected schools in Gombe State, where the sample 175 teachers were randomly selected. Measurements for the study were adapted from existing studies relevant to the research. Content validity was employed to ensure the validity of the instrument, Reliability was assessed using Cronbach's alpha, with coefficients ranging from .758 to .879, indicating sufficient internal consistency. The data were collected through personally administered questionnaires by the researchers and



trained research assistants. Data were collected using a structured questionnaire titled "AI in Education Assessment Scale (AIEAS)." on teachers' perceptions of AI use, teaching effectiveness, and encountered challenges. Data were analyzed using descriptive statistics such as frequency counts, percentages, and mean scores.

Results

The questionnaire contained three major sections: awareness of AI tools, usage of AI tools, and impact on teaching effectiveness. Responses from 175 teachers in Gombe State senior secondary schools are presented below.

Table 1: Teachers' Awareness of AI Tools (n = 175)

Item	Statement	Aware (f, %)	Not Aware (f, %)
1	I am aware of AI tools such as automated grading systems.	126 (72%)	49 (28%)
2	I know about adaptive learning platforms (e.g., personalized apps).	114 (65%)	61 (35%)
3	I am familiar with AI chatbots/virtual classroom assistants.	95 (54%)	80 (46%)
4	I know about AI-supported assessment tools.	119 (68%)	56 (32%)

The data indicates a generally high level of theoretical awareness among teachers, particularly concerning administrative and assessment-based AI. Automated grading systems recorded the highest level of awareness at 72% (n=126), followed closely by AI-supported assessment tools at 68% (n=119). This suggests that teachers are most cognizant of AI in areas that directly

impact their routine workload. However, awareness drops significantly when moving toward interactive technologies; only 54% (n=95) of respondents were familiar with AI chatbots or virtual assistants. This 18% gap between awareness of grading tools and chatbots suggests that about its conversational and pedagogical possibilities in the classroom

Table 2: Usage of AI Tools in Teaching (n = 175)

Item	Statement	Frequently Used (F, %)	Occasionally Used (F, %)	Not Used (F, %)
5	I use AI-based grading systems to evaluate students.	70 (40%)	49 (28%)	56 (32%)
6	I use adaptive learning apps to support instruction.	56 (32%)	63 (36%)	56 (32%)
7	I use AI-powered language or subject tutoring platforms.	49 (28%)	53 (30%)	73 (42%)
8	I use AI chatbots to handle student queries.	26 (15%)	35 (20%)	114 (65%)



Table 3: Perceived Impact of AI Tools on Teaching Effectiveness (n = 175)

Item	Statement	Strongly Agree (f, %)	Agree (f, %)	Disagree (f, %)	Strongly Disagree (f, %)
9	AI tools make lesson planning easier and more effective.	84 (48%)	63 (36%)	18 (10%)	10 (6%)
10	AI improves assessment transparency and reduces bias.	91 (52%)	53 (30%)	21 (12%)	10 (6%)
11	AI tools increase student engagement in the classroom.	70 (40%)	67 (38%)	26 (15%)	12 (7%)
12	AI tools reduce teacher workload and stress.	80 (46%)	60 (34%)	21 (12%)	14 (8%)

A comparison between Table 1 and Table 2 reveals a notable "awareness-usage gap." While 72% of teachers are aware of automated grading, only 40% (n=70) use them frequently. The most striking finding is the underutilization of AI chatbots, which are not used by 65% (n=114) of the respondents. Frequent usage is highest for grading systems (40%) and lowest for chatbots (15%). Interestingly, adaptive learning apps show a more balanced distribution, with 68% of teachers using them at least occasionally. This suggests that while teachers are beginning to integrate AI into instruction, their usage is largely restricted to "passive" or "backend" tools rather than "active" student-facing technologies like tutoring platforms or chatbots.

Teachers expressed a overwhelmingly positive view regarding the impact of AI on their effectiveness. The strongest consensus was found in Item 10, where 82% (n=144) of respondents agreed or strongly agreed that AI reduces bias and improves transparency in assessments. Furthermore, 84% (n=147) felt that AI makes lesson planning easier, and 80% (n=140) credited AI with reducing their overall workload and stress. Despite these positive indicators, a consistent skeptical minority (ranging from 16% to 20%) remains, either disagreeing or strongly disagreeing with the benefits of AI. This suggests that while the value proposition of AI is clear to the majority, nearly one in five teachers remains unconvinced of its practical efficacy.

Table 4: Challenges in the Use of AI Tools (n = 175)

Item	Statement	Strongly Agree (f, %)	Agree (f, %)	Disagree (f, %)	Strongly Disagree (f, %)
13	Poor internet connectivity hinders AI use.	112 (64%)	42 (24%)	14 (8%)	7 (4%)
14	Lack of adequate training limits AI integration.	102 (58%)	46 (26%)	18 (10%)	9 (6%)
15	Schools lack necessary ICT infrastructure for AI adoption.	105 (60%)	49 (28%)	14 (8%)	7 (4%)
16	Government support for AI in education is insufficient.	109 (62%)	39 (22%)	18 (10%)	9 (6%)



The barriers to AI adoption are systemic rather than individual. Poor internet connectivity was identified as the primary obstacle, with 88% (n=154) of teachers agreeing or strongly agreeing that it hinders AI use. This is closely followed by a lack of ICT infrastructure (88%) and insufficient government support (84%). Additionally, 84% (n=148) of teachers cited a lack of adequate training as a critical limitation. These figures indicate that the high awareness and positive perception noted in previous tables are being stifled by external factors. The data suggests that without targeted government intervention in infrastructure and professional development, the potential for AI to transform teaching in Gombe State will remain largely untapped.

Discussion of Findings

The findings of this study provide a nuanced look at the digital transition within senior secondary schools in Gombe State. The data reveals a significant paradox: while teachers are intellectually "ready" and optimistic about AI, the practical implementation is being stalled by environmental and systemic constraints.

The Awareness-Usage Gap

A critical takeaway from the data is the "Awareness-Usage Gap." While 72% of teachers are aware of AI grading systems, only 40% use them frequently. This gap is most pronounced in the area of AI Chatbots; despite 54% awareness, a staggering 65% of teachers have never used them. This suggests that awareness in Gombe State is largely "theoretical" or "conceptual." Teachers know these tools exist likely through social media or general news—but they have not been provided with the login access, software subscriptions, or technical "know-how" to integrate them into their daily pedagogy.

Pedagogical vs. Administrative Adoption

The results indicate that AI is currently viewed more as an administrative aid than

a pedagogical partner. Teachers strongly believe in AI's ability to reduce bias in grading (82%) and ease lesson planning (84%). However, usage drops when the tool requires student interaction, such as tutoring platforms or adaptive apps. This suggests that teachers are using AI to solve "back-office" problems (workload and grading) rather than using it to transform the "front-end" student experience.

Systemic Bottlenecks.

The most significant finding lies in the "Challenges" section. With 88% of respondents citing poor internet and 84% citing a lack of training, it is clear that the teachers' positive attitude toward AI is being met with a "digital brick wall." The high level of agreement regarding insufficient government support (84%) suggests that teachers feel they are being asked to innovate in an environment that does not yet have the basic ICT infrastructure to support that innovation.

Summary of Findings

Based on the empirical data presented, the following findings are summarized:

- 1 **High Theoretical Awareness:** A majority of teachers (54% to 72%) are aware of various AI tools, with the highest awareness focused on automated grading and assessment systems.
- 2 **Low Practical Integration:** Practical usage remains low, particularly for interactive tools. AI Chatbots are the most underutilized tool, with 65% of the sample reporting zero usage.
- 3 **Positive Perceived Impact:** There is a high level of optimism regarding AI's role in education. Over 80% of teachers believe AI improves assessment transparency, reduces workload, and simplifies lesson planning.



- 4 Critical Infrastructure Barriers: The adoption of AI in Gombe State is severely hindered by external factors. Internet connectivity (88%), lack of ICT infrastructure (88%), and inadequate training (84%) are the primary reasons for the slow pace of AI integration.
- 5 Requirement for Policy Intervention: 84% of teachers identified a lack of government support, indicating that policy-led initiatives are necessary to move AI from a concept into a classroom reality.

Conclusion

The findings of this study lead to the conclusion that senior secondary school teachers in Gombe State possess a high degree of digital readiness and a positive disposition toward Artificial Intelligence. There is a clear recognition that AI is not merely a futuristic concept but a functional necessity that can improve assessment transparency, boost student engagement, and alleviate the heavy burden of teacher workload.

However, a significant "implementation lag" exists. The transition from being "aware" of AI to "utilizing" AI is currently obstructed by a digital divide characterized by poor connectivity and a lack of hardware. While teachers are willing to embrace AI as a pedagogical partner, they are currently limited to using it for basic administrative tasks. Without a deliberate move from theoretical knowledge to practical, hands-on application supported by robust infrastructure the transformative potential of AI in the Gombe State educational system will remain unrealized.

Recommendations

To bridge the gap between teacher awareness and practical classroom

integration, the following recommendations are proposed:

- i. Institutionalized Professional Development: The Ministry of Education should transition from general ICT literacy programs to AI-specific pedagogical training. These workshops should focus on "Prompt Engineering" for teachers and the use of AI chatbots for personalized student tutoring, moving beyond simple automated grading.
- ii. Infrastructure "Leapfrogging": Given that 88% of teachers cited internet and infrastructure as primary barriers, the state government should prioritize the establishment of "AI-Ready Hubs" in each educational zone. These hubs should be equipped with high-speed satellite internet (such as Starlink or similar providers) to bypass local terrestrial connectivity issues.
- iii. Provision of Institutional AI Licenses: To encourage usage, the government should negotiate bulk institutional subscriptions for premium AI educational tools (e.g., Grammarly for Education, Canva Magic School, or adaptive learning platforms). This removes the financial burden from individual teachers who may otherwise be unable to access advanced AI features.
- iv. Development of an AI Policy Framework: The Gombe State Government should draft a State Policy on AI in Education. This framework would provide ethical guidelines for AI use, ensure data privacy for students, and signal a formal commitment to supporting teachers with the necessary resources and "government



support" that 84% of respondents currently feel is lacking.

- v. Curriculum Integration: The Ministry should encourage the integration of AI tools into the official lesson note preparation process. By officially recognizing AI-generated lesson plans and assessment rubrics, the state can formalize the "workload reduction

140.

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