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## Assessment of Teachers' Perception of Artificial Intelligence Technology on Academic Achievement in Physics among Secondary Schools in Plateau State, Nigeria

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### Abstract

*This study investigated the teachers' perception of artificial intelligence technology on academic achievement in physics among secondary schools in Plateau State, Nigeria. Guided by two objectives and two hypotheses respectively, grounded in Bento's AI Literacy Framework of 2020, the study explored teachers' perceptions of AI and examined whether gender differences influenced their effectiveness in utilizing AI to enhance learning outcomes. Using an ex post facto research design, a sample of 36 Physics teachers and 393 SS3 students were selected across 36 secondary schools during the 2024/2025 academic session in Plateau State. Data were collected using the Physics Teachers' AI Literacy Assessment Questionnaire (PTAILAQ) and a Physics Students' Academic Achievement Proforma (PSAAP). Descriptive statistics of mean and standard deviation was used to answer the research questions and inferential analyses of ANOVA & ANCOVA were used to test the two hypotheses at a 0.05 level of significance. Results revealed that teachers exhibited a high level of perception of AI as a useful tool for improving students learning. However, no significant effect was found between teachers' AI perception and students' academic achievement. The study concludes that while teacher's perception of AI is high, it does not directly translate to improved academic outcomes. Recommendations included targeted AI training, infrastructural support, and policy reforms to bridge the gap between perception and classroom practice.*

**Key Words:** *Physics teachers AI perception, Plateau State, Academic achievement.*

### Introduction

The integration of Artificial Intelligence (AI) in education has transformed the way teaching and learning occur. In physics teaching and learning, AI can enhance understanding and academic achievement by providing interactive simulations, personalized learning experiences, and real-time feedback (Kim & Lee, 2020; Spector, 2016). However, the effectiveness of AI integration largely depends on teachers' literacy levels in AI. Since the early 21st century, artificial intelligence (AI) has made remarkable strides, becoming a transformative force across various facets of society. In education, a significant and emerging area of AI research has evolved, viewing AI not merely as a tool, but as an integral component of the learning process. This paradigm shift has introduced the concept of AI literacy (Mertala et al. 2022), which extends beyond the confines of traditional education. AI literacy is defined as "a set of competencies that enable individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and use AI as a tool online, at home, and in the workplace" (Long & Magerko, 2020). To adequately prepare teachers and students for an AI-driven world, it is essential to offer AI learning opportunities that equip them with the requisite knowledge and skills, thereby fostering the development of AI literacy (Mertala et al., 2022). The advent of AI in education has opened new avenues for enhancing teaching and learning processes (Mertala et al., 2022). AI literacy among educators is crucial for leveraging these technologies effectively (Mertala et al., 2022). Physics, being a subject that requires both theoretical understanding and practical application, can significantly benefit from AI integration (Mahligawati, et al. 2023). Despite its potential, there is a gap in understanding the teacher's perception of AI among physics teachers and the effect on students' academic achievement in Plateau State, Nigeria.



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The academic achievement of students in physics remains a concern in many Nigerian secondary schools showing low performance in national examinations like the West African Examination Council (WAEC) and National Examination Council (NECO) (Mankilik & Umaru, 2015). While various factors contribute to this issue, the role of teachers' perception of AI tools as a valuable in education for influencing students' performance has not been adequately explored. This study aims to address this gap by examining the effect of physics teachers' artificial intelligence on students' academic achievement in senior secondary schools in Plateau State.

### **Purpose of the Study**

The purpose of this study is to investigate the effect of teachers' perception of AI on students' academic achievement in physics in senior secondary schools, Plateau State, Nigeria. Specifically, the study seeks to:

- (1). Determine the Physics teacher's perception of AI as a useful tool for improving student academic achievement in senior secondary schools in Plateau State.
- (2) Evaluate the Physics teacher's perception based on gender in senior secondary schools in Plateau State.

### **Research Questions**

The following questions guided the study.

1. To what extent do Physics teacher's perceive AI on improving students' academic achievement in senior secondary schools in Plateau State?
2. How does students' academic achievement in Physics relate to teachers' gender-based perception of AI on improving academic achievement in senior secondary schools in Plateau State?

### **Hypotheses**

The following null hypotheses were tested at 0.05 level of significance.

- H<sub>01</sub>. There is no significant effect of Physics teacher's perception of Artificial Intelligence (AI) on academic achievement in senior secondary schools in Plateau State.
- H<sub>02</sub>. There is no significant relationship between students' academic achievement in Physics and teachers' gender-based perception of AI on academic achievement in senior secondary schools in Plateau State.

### **Literature Review**

Based on the topic "Effect of Teachers Artificial Intelligence on Students' Academic Achievement in Physics in Senior Secondary Schools of Plateau State", the theoretical framework appropriate for this study is the Artificial Intelligence (AI) Literacy by Bento (2020) who proposes a framework for Artificial Intelligence (AI) literacy, emphasizing the importance of developing a comprehensive understanding of AI concepts, skills, and attitudes. The key components of AI Literacy Framework according to Bento are: (i). AI Knowledge: Understanding AI concepts, including machine learning, natural language processing, and computer vision. (ii). AI Skills: Developing skills in using AI-powered tools and technologies, such as programming languages, simulations, and data analysis software. (iii). AI Attitudes: Cultivating positive attitudes towards AI, including critical thinking, creativity, and ethical awareness. Bento's framework for AI literacy provides a comprehensive foundation for developing AI knowledge, skills, and attitudes. By integrating AI literacy into existing curricula, providing teacher training and support, and ensuring access to AI-powered tools and technologies, educators can prepare individuals for success in an increasingly AI-driven world. The importance of AI literacy are; AI literacy prepares individuals for future careers in an increasingly AI-driven workforce, AI literacy promotes critical thinking and problem-solving skills, essential for navigating complex AI-powered systems and AI literacy fosters ethical awareness and responsibility, crucial for ensuring AI systems are developed and used in ways that benefit society

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, particularly computer systems. In the context of education, AI comprises tools and systems designed to simulate intelligent behavior, automate administrative tasks, personalize instruction, and enhance learning experiences (Zhang & Lu, 2021). AI-powered applications such as intelligent tutoring systems, automated grading, personalized learning platforms, and predictive analytics have gained widespread adoption in various educational settings. In Physics education, AI plays a transformative role by providing interactive simulations, real-time feedback, and adaptive learning systems that align content with students' unique learning styles and cognitive abilities (Chen et al., 2020). These technologies not only enrich instruction but also address barriers such as large class sizes and lack of individualized support. AI literacy encompasses a set of knowledge, skills, and attitudes required to understand, evaluate, and use AI technologies effectively (Long & Magerko, 2020). Bento (2020) proposed a three-component framework for AI literacy: (i) AI Knowledge, which includes understanding core concepts such as machine learning, natural language processing, and data science; (ii) AI Skills, including the ability to use AI tools such as simulations



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and analytics software; and (iii) AI Attitudes, such as ethical awareness and critical thinking about AI applications. Kong et al. (2021) further advanced the discourse by emphasizing four pillars of AI literacy: recognizing and understanding AI, using and applying AI, evaluating and creating AI, and understanding AI ethics. The growing integration of AI into everyday life necessitates that educators be AI-literate to guide students effectively in navigating an increasingly AI-driven world. Teacher perception is critical to the successful adoption and integration of AI tools in classroom settings. Teachers who perceive AI as useful and aligned with their pedagogical goals are more likely to integrate such tools into their teaching practice (Ng et al., 2021a). Haleem et al. (2022) argue that AI in education enhances not only learner engagement but also streamlines administrative tasks, enabling teachers to focus on more meaningful instructional tasks.

However, Zhao et al. (2022) caution that without adequate training and exposure, teachers may view AI with skepticism, potentially hindering its adoption. Thus, positive perception must be coupled with adequate institutional support and professional development to ensure effective use of AI in teaching and learning. Physics, being an abstract and conceptual subject, benefits significantly from the integration of AI. Visualization tools, virtual laboratories, and adaptive assessments help demystify complex theories and promote experiential learning. AI enables differentiated instruction, catering to students' unique needs, pacing, and readiness levels (Zhai et al. 2021). Lee et al. (2021) observed that integrating AI into high school Physics classrooms improved students' conceptual understanding and fostered a future-oriented mindset towards STEM careers. Moreover, AI-assisted instruction was shown to increase learner autonomy and confidence in navigating difficult content areas. Gender disparities in technology use and adoption have been widely studied. However, recent findings suggest that both male and female teachers can exhibit high AI literacy and efficacy if given equal training opportunities (Kong et al., 2023a). While some studies indicate subtle differences in how male and female educators perceive and apply AI tools often linked to their prior exposure or teaching, these differences are not always statistically significant (Su & Yang, 2023). In Plateau State, Nigerian contexts, societal and cultural expectations may influence gender roles in STEM education, including the use of digital tools. Nevertheless, efforts toward gender-equitable training and resource access are bridging these gaps, allowing for more uniform integration of AI in classrooms.

Academic achievement is influenced by numerous factors, including teacher competency, instructional strategies, and available technology. The integration of AI has the potential to significantly impact student outcomes by providing real-time feedback, personalized learning pathways, and intelligent diagnostics that help identify learning difficulties (Van Esch & Black, 2021). Sahu et al. (2022) highlighted that students exposed to AI-based instruction generally perform better due to increased engagement and tailored content. However, this depends largely on the teachers' ability to effectively implement AI in instruction. Therefore, a teacher's AI literacy becomes a key determinant in maximizing the benefits of AI in education. Empirical evidence on the relationship between teacher AI literacy and student academic achievement is emerging. Studies by Kong et al. (2023a) found that high school teachers trained in machine learning and deep learning concepts were more capable of designing AI-driven learning experiences that positively impacted student engagement and performance. Similarly, Su et al. (2023) evaluated an AI literacy program and observed that improved teacher understanding of AI led to higher creativity and academic engagement among learners. These studies reinforce the idea that teacher AI literacy is not only necessary for professional development but also essential for enhancing students' academic performance. The reviewed literature underscores the pivotal role of AI in transforming education, especially in science subjects like Physics. Teachers' AI literacy, encompassing knowledge, skills, and attitudes, significantly influences the effectiveness of AI integration in teaching. While teacher perceptions are generally positive, actual classroom application depends on institutional support, infrastructure, and training. Although gender-based differences in perception exist, they are not definitive predictors of academic outcomes. Ultimately, improving teacher AI literacy could bridge the gap between technology potential and student academic success.

### **Methodology**

The study adopted an *expos facto* research design due to fact that the researchers did not manipulate any variable of discourse. A sample of thirty-six Physics teachers from a target population of 311 with 22,985 students' from Senior Secondary Three (SSIII); A sample of thirty-six physics teachers; and 393 students offering Physics in senior secondary schools in Plateau State, Nigeria, this was drawn using Taro Yamane's formula (Yamane, 1967), through random sampling technique a total of thirty-six senior secondary schools who participated in the study. Data were collected using a Physics Teachers' Perception of AI Questionnaire (PTPAIQ) and Physics Students' Academic Achievement Proforma (PSAAP). The PTPAIQ had ten items with the following response modes Very High Extent (VHE) = 5 points, High Extent (HE) = 4 points, Moderate Extent (ME) = 3 points, Low Extent (LE) = 2 points and Very Low Extent (VLE) = 1 point. The instruments were trial tested after its validity by experts and yields Cronbach's Alpha value of  $r=0.83$  which shows a good instrument. The PTPAIQ assessed teachers'



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knowledge and perception of AI in teaching Physics. Statistical analysis was conducted using descriptive statistics with decision ruled by real limits of numbers and inferential statistics (ANOVA and ANCOVA) for hypotheses testing at 0.05 alpha with decision rule that when  $P < 0.05$  the null hypothesis is rejected and when  $P > 0.05$  then we do not reject the null hypothesis and conclude there is no significant relationship.

### Presentation of Results

The results of the study were presented in tables and discussions as follows:

**Research Question One:** To what extent do Physics teacher's perceive AI on improving students' academic achievement is senior secondary schools in Plateau State?

#### Answering Research Question One:

**Table 1: Responses from Extent Physics Teacher's Perceive AI as Useful Tool for Improving Students' Academic Achievement in Senior Secondary Schools in Plateau State**

S/N	Statement: n=393	Mean	S.D	Remark
1.	I believe AI can enhance student interest in physics.	4.19	1.75	HE
2.	I believe AI can improve student learning outcomes in physics.	4.19	0.71	HE
3.	I perceive AI as a useful tool for supporting personalized learning.	4.06	0.75	HE
4.	I believe AI can help reduce the workload associated with grading assessment.	3.94	0.79	HE
5.	I believe AI can enhance student teamwork in physics.	4.08	0.77	HE
6.	I generally recognize the potential of AI to support teacher professional development.	4.19	0.67	HE
7.	I believe AI can improve student access to quality physics learning.	4.14	0.72	HE
8.	I perceive AI as a useful tool for addressing equity with inclusion issues.	3.97	0.74	HE
9.	I often see AI as a means to support student-centered learning instruction.	4.00	0.76	HE
10.	Perceived usefulness of AI in physics education is influenced by my prior experience with technology.	4.33	0.82	HE
Grand total average		4.11	0.85	HE

Table 1 examines the perception of AI as a useful tool for enhancing students learning outcomes among the physics teachers. The overall mean score is 4.11 with a standard deviation of 0.85, indicating a High Extent (HE) of AI literacy level. All items reflect high extents perception of AI as important tool in education, such as Perceived usefulness of AI in physics education is influenced by my prior experience with technology (Mean = 4.33, S.D = 0.85. Other items, like I believe AI can help reduce the workload associated with grading assessment (Mean = 3.94, S.D = 0.79), I often see AI as a means to support student-centered learning instruction (Mean = 4.00, S.D = 0.76, and I perceive AI as a useful tool for addressing equity with inclusion issues. (Mean = 4.00, S.D = 0.74), all fall into the high-extent category. The overall result implies that physics teacher's perception of AI as a useful tool for improving student learning outcomes in physics is not an issue among Physics teachers in senior Secondary Schools in Plateau State.

**Hypothesis One:** There is no significant effect of Physics teacher's perception of Artificial Intelligence (AI) as a useful tool for improving student learning outcomes on academic achievement in senior secondary schools in Plateau State.

#### Testing Hypothesis One

**Table 2: Summary of ANOVA from Physics Teacher's Perception of AI as Useful Tool for Improving Student Learning Outcomes on Academic Achievement in Senior Secondary Schools in Plateau State.**



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Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
1 Corrected model	915.140 <sup>a</sup>	10	91.514	1.347	.231
Intercept	377.956	1	377.956	5.562	.035
Teacher's perception of AI	113.424	10	113.424	1.669	.354
Error	1698.757	25	194.847	2.967	.103
Total	85318.070	36	67.950		
Corrected total	2613.896	36			

R. Square=0.350 (Adjusted R square=0.90)

Table 2 summarizes the results of an ANOVA-based on analysis conducted to determine effect of Physics teacher's perception of AI as a useful tool for improving student learning outcomes on academic achievement in physics. The results reveal that there is no significant effect on students' academic achievement in physics,  $F(1.669, p=0.35 > 0.05)$ . Since the p-value (0.354) is higher than the alpha value of 0.05, the null hypothesis is not rejected.

**Research Question Two:** How does students' academic achievement in Physics relate to teachers' gender-based perception of AI on improving academic achievement in senior secondary schools in Plateau State?

**Answering Research Question Two:**

**Table 3: Mean and Standard Deviation for Students' Academic Achievement in Physics According to Teachers' Gender-Based Perception of AI on Academic Achievement in Senior Secondary Schools in Plateau State.**

Gender	N	Mean	S. D
Male	27	46.94	8.58
Female	9	50.90	8.51
Total	36	47.93	47.93

Table 3 reports the mean academic achievement score of students offering Physics in senior secondary schools in Plateau State based on their teachers' gender. With a sample size of 393 students, the mean academic achievement score is 46.94 and 50.90, with a standard deviation of 8.58 and 8.51 respectively. This suggests that on average, students' academic achievement in Physics is moderate for both students taught by male or female teachers, showing that gender and perception of AI as useful tool makes no difference in academic achievement but there is a considerable variation in their academic achievement extents. The standard deviation indicates a wide dispersion of scores around the mean, highlighting differences in students' individual academic achievement in Physics in Plateau State. Male teachers: ME = 46.94 (SD = 8.58), Female teachers: ME = 50.93 (SD = 8.51) This suggests difference between genders, confirming that gender may play a significantly impact academic outcomes.

**Hypothesis Two:** There is no significant interaction effect of Physics teachers' perception based on gender, of AI as a useful tool for improving student learning outcomes in senior secondary schools in Plateau State.

**Testing Hypothesis Two**

**Table 4: Summary of ANCOVA from Physics Teacher's Perception Based on Gender, of AI as Useful Tool for Improving Student Learning Outcomes on Academic Achievement in Senior Secondary Schools in Plateau State.**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
1 Corrected model	942.820 <sup>a</sup>	11	85.711	1.231	.320
Intercept	346.777	1	346.777	4.980	.035
Gender	27.681	1	27.681	0.398	.379
Teachers perception of AI	103.8774	10	103.8774	1.492	.379
Error	1671.076	24	69.628		
Total	85318.070	36			
Corrected Total	2613.896	36			

a. R. Square=0.361 (Adjusted R square=0.068)

Table 4 summarizes the results of an ANOVA-based on analysis conducted to determine effect of Physics teacher's perception based on gender, of AI as a useful tool for improving student learning outcomes on academic achievement in physics. The



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results reveal that there is no significant effect on students' academic achievement in physics,  $F(1.492, p=0.38 > 0.05)$ . Since the p-value (0.379) is higher than the alpha value of 0.05, the null hypothesis is not rejected.

### Discussion of Findings

Findings from Table 1 indicates that Physics teachers hold a high level of positive perception toward AI as a valuable educational tool for improving student learning outcomes. With a grand mean score of 4.11 and consistent "High Extent" (HE) ratings across all ten indicators, it is evident that teachers recognize AI's potential to personalize learning, enhance student engagement, and reduce administrative workload. This result is aligned with Bento's (2020) AI Literacy Framework, which emphasizes the importance of developing educators' knowledge, skills, and attitudes toward AI integration. Moreover, this outcome aligns with prior studies (Zhai et al., 2021; Haleem et al., 2022), which confirm that teachers' attitudes are critical for adopting AI in classroom instruction. It also supports Kong et al. (2023a), who noted that AI literacy is increasingly necessary across all levels of education to prepare teachers for future classroom environments.

The results from Table 2 indicate no statistically significant effect of Physics teachers' perception of AI on student academic achievement in senior secondary schools in Plateau State ( $F = 1.669, p = 0.354 > 0.05$ ). Thus, the null hypothesis is retained, suggesting that while teachers generally have a positive perception of AI, this perception does not directly or significantly influence student outcomes. This may be due to several factors, including inconsistent implementation of AI tools, lack of appropriate infrastructure, or limited professional training in effectively integrating AI technologies into instruction. It may also reflect a disconnect between teacher perception and practical classroom usage, highlighting the need for actionable strategies and support structures to translate positive perception into effective AI-enhanced teaching. From the results shown in Table 3, students taught by female Physics teachers scored higher on average (Mean = 50.90) than those taught by their male counterparts (Mean = 46.94). Although both results fall within a moderate performance range, the difference suggests a possible gender related influence in how AI is perceived and implemented in the classroom. However, this variation was not statistically significant according to hypothesis testing, meaning that gender alone does not create a significant impact on students' academic performance in Physics. This observation may reflect complex differences in teaching styles and other factors between genders, which could affect students' academic achievement in Physics. Nevertheless, as AI integration becomes more common, these differences may lessen as instructional strategies may become more standardized. According to the ANOVA results in Table 4, there is no statistically significant interaction effect between teachers' perception of AI based on gender and students' academic achievement in Physics in senior secondary schools in Plateau State ( $F = 0.398, p = 0.379 > 0.05$ ). Therefore, the null hypothesis is not rejected. Although female teachers' students performed slightly better, the result implies that gender does not significantly moderate the relationship between AI perception and students' academic achievement in Physics in senior secondary schools in Plateau State. This supports the idea that gender neutrality exists in effective AI perception among educators, and both male and female teachers are capable of integrating AI in ways that promote student achievement provided they receive equal access to training and support.

### Conclusion

The study on effect of teacher's perception of artificial intelligence on students' academic achievement in senior secondary schools, Plateau Nigeria concludes that while teacher's perception of AI is high, it does not directly translate to improved academic achievement.

### Recommendations

The findings of this study have several implications for educational stakeholder

1. Despite positive perceptions of AI, the lack of significant impact on student achievement suggests that more robust training is needed to equip teachers not just with the right attitudes but also the skills to implement AI tools effectively in class instruction.
2. Education policymakers for senior secondary schools in Plateau State should consider integrating AI literacy into teacher education curricula and provide regular workshops for in-service teachers.
3. Both male and female teachers should be provided equal opportunities to learn and utilize AI tools, ensuring gender sensitive classroom benefits.
4. It is essential to translate positive teacher perception into concrete classroom practices by providing AI-based resources, monitoring, and instructional guidelines tailored for Physics education.

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