UNIJERPS
Unizik Journal of Educational Research and Policy Studies VOL.22 (1);
July-December, 2026 https://unijerps.org
2023 Impact Factor: 6.834; 2022 *Impact Factor*: 5.156; *2021 Impact Factor: 5.641; 2020 Impact Factor: 5.355. Indexing and Impact Factor URL:*
http://sjifactor.com/passport.php?id=21363

TEACHERS' PERCEPTION ON APPLICATION OF ARTIFICIAL INTELLIGENCE IN TEACHING AND LEARNING OF PHYSICS

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ABSTRACT

The study investigated teachers' perception on application of Artificial Intelligence (AI) in teaching and learning of Physics. The study was guided by two research questions and one null hypothesis. The study adopted a descriptive survey design. The population of the study comprised 207 Physics teachers in public secondary schools across three education zones (Abakaliki, Afikpo and Onueke) in Ebonyi State. The sample size was 90 Physics teachers selected using stratified random sampling technique to ensure proportional representation across the three zones. One instrument was used for data collection: Teachers' Perception on Application of Artificial Intelligence in Teaching and Learning of Physics Questionnaire (TPAAITLPQ). The instrument was face validated by three experts from science education and measurement and evaluation. The reliability of TPAAITLPQ was determined using Cronbach's alpha method with an index value of 0.91. Mean and standard deviation were used to answer the research questions while independent samples t-test was used to test the hypothesis at 0.05 level of significance. The findings revealed that Physics teachers have positive perception on the application of Artificial Intelligence in teaching and learning of Physics. Also, age does not significantly influence Physics teachers' perception on the application of Artificial Intelligence. It was recommended that school administrators and the Ebonyi State Ministry of Education should ensure adequate provision of AI-enabled facilities, stable internet connectivity and continuous professional development to promote effective integration of AI in Physics instruction.

Keywords: Artificial Intelligence, Teachers' Perception, Teaching and Learning, Physics, Secondary Education

Introduction

In recent years, the rapid advancement of digital technology in the teaching and learning process has necessitated adaptation to the changing demands of the 21st century where conceptual understanding, problem-solving, critical thinking, and scientific reasoning are essential skills in Physics Education (Simhadri & Swamy, 2023). These technological advancements which may include the use of digital teaching tools

and innovative technologies, particularly the application of Artificial Intelligence (AI), are becoming inevitable in the instructional process. However, empirical evidence suggests that many Physics teachers may be unaware or inadequately prepared to use AI technologies, while some may be aware but hold either negative or positive attitudes toward the use of these innovative technologies in teaching and learning of Physics (Ogbu, 2025; Eze & Onah, 2022). Some researchers have also argued that the persistent use of outdated teaching methods and limited awareness of digital teaching tools in secondary school classrooms may result in low students' learning outcomes, conceptual understanding, and performance especially in Physics (Ogbu & Ugwu, 2023; Ezeugwu & Nwankwo, 2020).

The teaching and learning of Physics aims at developing students' ability to reason scientifically, apply laws and principles to everyday phenomena, and empower students with scientific literacy and competence. The main objectives of Physics in the secondary school curriculum in Nigeria as asserted by the Nigerian Educational Research and Development Council (NERDC, 2018) include cultivating understanding and application of Physics skills and concepts necessary to thrive in an ever-changing technological world, acquiring scientific literacy required to function in an information age, developing essential elements of problem-solving and inquiry, taking advantage of career opportunities provided by Physics, and becoming prepared for further studies in Physics and related fields.

Difficulty in problem-solving and conceptual application in Physics could result from students' poor understanding of fundamental concepts. Physics is not just about formulas and calculations; it teaches critical thinking, experimental reasoning, and problem-solving skills. Poor academic achievement in Physics can hinder students' ability to think critically and limit their overall scientific reasoning (Ogbu et al., 2023; Sa'ad et al., 2018). Limited exposure to practical and digital resources could also contribute to poor knowledge of Physics. Physics is essential in understanding technological innovation, energy management, and engineering design. Students who struggle with Physics may lack the necessary skills to make informed technological decisions, which can impact their career prospects later in life (Ogbu et al., 2023; Sa'ad et al., 2018). Students who struggle with Physics may be limited in their career options in STEM, leading to lower participation in engineering and technology-related fields.

Continuous poor academic achievement in Physics can lead to disengagement from science learning in general. Students may become frustrated, lose interest in science, and develop negative

attitudes toward STEM education. Okoro et al. (2023) and Ogbu (2025c) opined that poor academic achievement in Physics can perpetuate educational inequalities, as access to certain science-based fields and opportunities often requires a strong background in Physics. This can further contribute to social and economic disparities. To ameliorate the issue of poor achievement in Physics in Ebonyi State, it is important to invest in improving educational amenities, such as well-equipped Physics laboratories and teaching materials. Aduloju and Adedotun (2025) added that recruiting and training qualified Physics teachers can help enhance instructional quality. This is in agreement with Ogbu and Anyaegbu (2021) who noted that the quality of instruction is a function of teacher qualification. An updated curriculum that emphasizes conceptual understanding, practical work, and problem-solving skills, along with innovative teaching methods, can also help promote better achievement in Physics. Efforts should be made to address socioeconomic inequalities and provide equal access to educational resources for all students. Public awareness campaigns that promote the importance and relevance of Physics can also help change negative attitudes and perceptions toward the subject (Ogbu, 2025b; Okoro et al., 2023). However, there is growing demand that artificial intelligence should be deployed in teaching and learning of Physics as it can help enhance students' understanding of abstract concepts (Ajinuhi & Honmane, 2024; Ogbu & Emeji, 2023).

Artificial intelligence is the development of computer systems capable of performing tasks that normally require human intelligence. These tasks may include problem-solving, speech recognition, pattern recognition, decision-making, and learning. Artificial intelligence is also applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving. According to Offor et al. (2024), artificial intelligence is a learning machine that focuses on enabling computer systems to learn and make decisions or predictions based on data, without being explicitly programmed. Artificial intelligence allows systems to improve performance over time through experience. Ekwu et al. (2025) define artificial intelligence as the ability of computers to understand, interpret, and create human language as well as enabling tasks like machine translation, speech recognition, and sentiment analysis. Artificial intelligence is the development of systems capable of understanding and interpreting visual information from digital images or video. Artificial intelligence is a machine that can solve problems, think, make decisions, and learn from experience just like human beings.

The benefits of artificial intelligence cannot be overstated; integrating

Artificial Intelligence into Physics classrooms could improve students' understanding of abstract concepts such as mechanics, electromagnetism, and quantum phenomena, but some authors opined that teachers must have a positive attitude toward the use of technology to bring about application of AI in the Physics classroom (Okoro et al., 2023). Artificial intelligence in this study refers to the ability of systems to possess the capacity to learn, understand, and apply knowledge across diverse domains, including Physics, similar to human intelligence. Artificial intelligence would be capable of reasoning, adapting to new situations, problem-solving, and potentially supporting Physics instruction through intelligent tutoring systems, simulations, and adaptive assessments (Ekwu et al., 2025). Teachers must properly perceive the usage of Artificial Intelligence in teaching Physics for easy utilization in the classroom. However, Artificial Intelligence if not used appropriately may affect students' academic achievement in Physics. Artificial Intelligence plays a vital role in teaching and learning of Physics and teachers should have a positive attitude toward the applications of Artificial Intelligence in Physics education. Eke (2024) addressed that one of the ways to make teachers integrate Artificial Intelligence efficiently in the Physics classroom is by having positive attitudes or perception toward the use of this tool known as Artificial Intelligence in teaching and learning of Physics.

Teachers' perception refers to how teachers see their own role, responsibilities, and expertise as educators. Aduloju and Adedotun (2025) were of the view that teachers' perception encompasses their understanding of pedagogical practices, subject knowledge, and their ability to effectively facilitate student learning. Teacher's perception also includes how teachers perceive their own strengths and weaknesses, their level of confidence in their teaching abilities, and their willingness to engage in continuous professional development. According to Onuh and Onoge (2025), teachers' perception is also defined as how teachers perceive their students, including their abilities, backgrounds, interests, and motivations. Teachers' perceptions of students can influence their instructional practices, as they tailor their teaching methods and strategies to meet the diverse needs of their students. It also encompasses how teachers interpret and understand their students' learning difficulties, strengths, and preferences, allowing them to adjust their instruction accordingly. It is expected however, that Physics teachers integrate Artificial Intelligence in teaching and learning of Physics and this can only be achieved if they have the right perception of Artificial Intelligence (Egara & Mosimege, 2024).

However, teachers could have positive or negative perception in the applications of Artificial Intelligence in teaching and learning Physics. Considering the fact that there is poor achievement of students in Physics in Ebonyi State, one could say that there may be presence of teachers' low perception in the use of Artificial Intelligence which could result in poor achievement in Physics (Egara & Mosimege, 2024). Some reasons for negative or positive perception, low or high perception may be due to the reasons below. Firstly, there might be lack of understanding of the benefits and potential use of Artificial Intelligence. Secondly, teachers may be skeptical or resistant to incorporating technology into their teaching methods, viewing it as a threat to their traditional role and expertise. Thirdly, teachers may also have concerns about their ability to adapt and effectively use these tools in the classroom, especially if they have limited training or exposure to technology. The lack of infrastructure and teaching resources in schools could contribute to teachers' negative perception. Okoro et al. (2023) were of the view that inadequate access to computers, internet connectivity, and necessary software may hinder the application of Artificial Intelligence in teaching and learning of Physics in secondary schools. The limited availability of technical support and training to effectively integrate Artificial Intelligence into the curriculum can also deter teachers from embracing them.

Furthermore, the fear of technology replacing the teacher in the classroom may hinder teachers from adopting AI tools, as they may worry that technology will replace the need for human instruction in Physics education (Okoro et al., 2023). Zulkarnain and Yunus (2023) reported that teachers have a very good and positive perception of the use of Artificial Intelligence in teaching and learning. Also, Aduloju and Adedotun (2025) reported in their study that primary school teachers were found to have a good and positive perception of the use of AI in the classroom and strongly agreed that AI can improve teacher productivity in the classroom whereas in another view, a study was carried out by Lai et al. (2020) on perceptions of Artificial Intelligence and came up with the findings that various respondents saw Artificial Intelligence as a falsehood to be exposed and opined that there was low and negative perception among the respondents. One of the factors that could be responsible for the application of Artificial Intelligence among Physics teachers in Ebonyi State may be teachers' age.

Age is simply the number of years a person has lived since birth. Ugwu et al. (2023) pointed out that age is commonly determined by counting the number of years, months, and days starting from a person's date of birth. Ugwu et al. (2023) addressed that in certain cases, especially for infants and toddlers, age may be

defined in terms of months rather than years. This allows for a more precise understanding of a person's developmental progress and milestones. In some situations, such as in medical or scientific research, age may be defined in terms of the exact number of days since a person's birth. This level of granularity can be particularly relevant for studying early developmental stages or measuring specific periods of time (Ugwu et al., 2023). In this study, age is the number of years that Physics teachers have stayed from birth. Age of the teachers may be one of the factors affecting the teachers' applications of Artificial Intelligence in teaching and learning Physics in Ebonyi State. The age of teachers may or may not significantly impact the application of Artificial Intelligence in teaching and learning of Physics. Bridging the digital divide among teachers of different age groups could be divided into digital natives (below 35 years) and digital immigrant teachers (35 years and above) (Ugwu et al., 2023). Digital native and digital immigrants are different age groups that make up teachers of different age ranges in Physics classroom who are either below the age of 35 years or above 35 years possessing digital literacy skills and use of innovative technologies in the teaching and learning process and may be capable of affecting teachers' awareness and perception on the application of Artificial Intelligence in teaching and learning of Physics (Ugwu et al., 2023).

The older teachers may face challenges in adopting AI in their Physics teaching practices due to a lack of familiarity with technology or apprehension toward learning new tools and platforms. Eke (2024) stated that teachers might require more training and support to develop the necessary skills and confidence in using AI in the classroom. Overcoming resistance to change and addressing any concerns about job security or displacement by technology are also important factors to consider for older teachers. The introduction of Artificial Intelligence will provide old teachers with appropriate training and support, and fostering a positive attitude toward AI integration in Physics instruction which could help ensure successful application of AI techniques in teaching and learning in Ebonyi State (Okoro et al., 2023). Ayanwale et al. (2022) reported in their study that age significantly influences teachers' use of Artificial Intelligence in favor of teachers below 30 years. However, Khanal et al. (2020) were of the view that age does not significantly influence the use of digital technology especially the use of Artificial Intelligence in teaching and learning. Since age of the teachers may have the capacity to affect the application of Artificial Intelligence in teaching and learning, it becomes imperative to investigate its influence among Physics teachers in Ebonyi State.

Statement of the Problem

The rapid advancement of digital technology has brought a need to adapt to the changing demands of the 21st century where problem-solving, critical thinking, logical and analytical reasoning are very essential skills in Physics Education. These technological advancements which may include the use of digital teaching tools and innovative technologies are inevitable in the teaching and learning process. One of the digital technological teaching tools used in the teaching and learning process is Artificial Intelligence. Artificial Intelligence (AI) is the use of computers to perform specific tasks such as problem-solving, simulation of Physics phenomena, and logical reasoning which may enhance teaching and learning and may provide opportunities for student engagement and teacher effectiveness.

Despite the importance attached to Artificial Intelligence, empirical evidence shows problems which could affect its application including teacher negative attitudes, limited teacher training on the use of technology, inadequate professional development, and inability of teachers to use digital tools such as AI in teaching. These educational problems still persist despite efforts made by the government, educators, teachers, stakeholders, and researchers. Several studies have shown that many Physics teachers may not be adequately prepared for the use of Artificial Intelligence in teaching and learning which may improve Physics instruction and achievement. However, some researchers pointed out that some teachers have positive attitude toward the perception of AI. Due to inconsistencies by researchers, the researcher deemed it necessary to investigate if Physics teachers in Ebonyi State are aware and how they perceive the use of Artificial Intelligence in their Physics instruction considering teachers' age groups as an influential factor. Therefore, the purpose of this study is to investigate teachers' perception on application of Artificial Intelligence in teaching and learning of Physics in secondary schools in Ebonyi State.

Research Questions

1. What is the perception of teachers on application of Artificial Intelligence in teaching and learning of Physics in secondary schools in Ebonyi State?
2. What is the influence of age on teachers' perception on application of Artificial Intelligence in teaching and learning of Physics in secondary schools in Ebonyi State?

Hypothesis

$H0_1$: There is no significant influence of age on teachers' perception on application of

Artificial Intelligence in teaching and learning of Physics in secondary schools in

Ebonyi State.

Method

The study adopted a descriptive survey research design. According to Nworgu (2015), descriptive survey research design aims at collecting data and describing, in a systematic manner, the attributes of a specific population. This design was considered appropriate because the researcher was not interested in manipulating any variable but rather in eliciting, describing, and comparing the perception of Physics teachers regarding the application of Artificial Intelligence as it naturally exists. The study was carried out in all public secondary schools in Ebonyi State. Ebonyi State was chosen because it comprises three education zones (Abakaliki, Afikpo and Onueke) with a fair mix of urban and rural schools, making it representative for examining Physics teachers' perception. The population of the study comprised all 207 Physics teachers in public secondary schools in Ebonyi State. The qualification of the teachers ranged from NCE to Ph.D. The sample size for the study was 90 Physics teachers drawn from the three education zones. Stratified random sampling technique was used to ensure proportional representation: 35 teachers from Abakaliki zone, 30 from Afikpo zone, and 25 from Onueke zone. This sampling approach ensured that both urban and rural schools were adequately represented. The 207 total Physics teachers represent all three education zones in Ebonyi State.

The instrument was used for data collection: Teachers' Perception on Application of Artificial Intelligence in Teaching and Learning of Physics Questionnaire (TPAAITLPQ). The instrument was developed by the researcher based on the research questions. It was structured into two sections: Section A elicited demographic information (age, education zone), Section B comprised 20 items on perception of AI application in Physics, structured on a four-point rating scale of Strongly Agree (SA=4), Agree (A=3), Disagree (D=2), and Strongly Disagree (SD=1). The instrument was subjected to face validation by three experts from University of Nigeria, Nsukka and Ebonyi State University – two in Physics Education and one in Measurement and Evaluation. Their corrections were used to produce the final version. To establish internal consistency, a trial testing was carried out using 20 Physics teachers in private schools not part of the study area and data generated were analyzed using Cronbach's alpha. A reliability coefficient of 0.91 was obtained, indicating high reliability. The method of data collection was direct administration with the help of three research assistants. The copies of the questionnaire were administered to the 90 sampled Physics teachers in their various schools and retrieved on the spot, ensuring 100%

return rate. Data were screened for missing values and none was found. Analysis was conducted using SPSS version 27. Mean and standard deviation were used to answer research questions with a criterion mean of 2.50 (0.00-2.49 disagree, 2.50-4.00 agree). Independent samples t-test was used to test the hypothesis at 0.05 level of significance.

Results

Research Question 1: What is the perception of teachers on application of Artificial Intelligence in teaching and learning of Physics?

Table 1: Perception of Teachers on Application of Artificial Intelligence in Teaching and Learning of Physics

S/N	Item Statement	Mean	SD	Decision
1	I am interested in using AI systems in teaching Physics	3.18	0.77	Agree
2	There are many beneficial applications of AI in teaching Physics	3.31	0.70	Agree
3	AI is exciting when applied in teaching Physics concepts	3.19	0.91	Agree
4	AI can provide new opportunities for teaching Physics (simulations, virtual labs)	3.34	0.71	Agree
5	I prefer to use AI in teaching Physics	3.02	0.88	Agree
6	I will be more effective than other Physics teachers if I apply AI	3.12	0.90	Agree
7	I am impressed by what AI can do in teaching Physics	3.26	0.82	Agree
8	AI can have positive impacts on students if I teach Physics using AI	3.18	0.79	Agree
9	AI makes me feel happier when teaching Physics	2.98	0.81	Agree
10	AI can perform better than a teacher if allowed to teach some Physics topics	2.81	0.98	Agree
11	Much of society will benefit from a future full of AI when applied in Physics	2.99	0.92	Agree
12	For Physics topics I found difficult, I would rather interact with AI than a fellow teacher	2.86	0.95	Agree
13	I often think that AI is dangerous when applied in teaching Physics	2.28	0.93	Disagree
14	My school uses AI unethically	2.02	0.84	Disagree
15	I find that AI is not favourable to me when applied in teaching Physics	2.31	0.96	Disagree
16	AI is used to monitor the activities of my fellow teachers	2.20	0.91	Disagree
17	I shiver with discomfort when I think about future uses of AI in Physics	2.36	1.02	Disagree
18	AI might take control of teaching and learning Physics	2.11	0.74	Disagree
19	AI makes many errors when teaching Physics	2.33	0.88	Disagree
20	People like me will suffer if AI is used more in teaching Physics	2.48	1.01	Disagree
	Cluster Mean	2.81	0.35	Agree

Table 1 shows the mean and standard deviation of teachers' perceptions on application of AI in teaching and learning of Physics. The results in Items 1 to 12 showed high mean scores ranging from 2.81 to 3.34, indicating agreement which implies that Physics teachers have positive perception on application of AI in Physics. Items 13 to 20 showed low mean scores ranging from 2.02 to 2.48, indicating disagreement with negative statements about AI, which further confirms positive perception. The cluster mean of 2.81 with SD of 0.35 is above the 2.50 criterion, showing overall positive perception. This suggests that teachers in Ebonyi State are willing and interested in integrating AI tools such as intelligent tutoring and virtual laboratories into Physics instruction.

Research Question 2: What is the influence of age on teachers' perception on application of AI in teaching and learning of Physics?

Table 2: Influence of age on Teachers' Perception on Application of AI in Teaching and Learning of Physics

S/N	Items	Below 35yrs (n=42) Mean	SD	35yrs & above (n=48) Mean	SD	Decision
1	Interested in using AI in Physics	3.21	0.80	3.15	0.74	Agree
2	Beneficial applications of AI	3.42	0.60	3.21	0.75	Agree
3	AI is exciting in Physics	3.22	0.89	3.16	0.93	Agree
4	AI provides new opportunities	3.48	0.61	3.22	0.78	Agree
5	Prefer to use AI	3.18	0.85	2.88	0.90	Agree
6	More effective with AI	3.30	0.86	2.96	0.92	Agree
7	Impressed by AI in Physics	3.30	0.73	3.22	0.89	Agree
8	Positive impact on students	3.20	0.74	3.16	0.84	Agree
9	Happier teaching Physics with AI	3.02	0.82	2.94	0.80	Agree
10	AI can perform better	2.90	1.02	2.73	0.94	Agree
	Cluster Mean	2.89	0.30	2.73	0.36	Agree

Table 2 shows mean and standard deviation of influence of age (below 35 years and 35 years and above) on teachers' perception of AI in Physics. Both age groups had high mean scores on positive items ranging from 2.88 to 3.48, indicating agreement and positive perception across age categories. The cluster mean for teachers below 35 years is 2.89 while that for 35 years and above is 2.73, both above the criterion mean. The standard deviation for younger teachers (0.30) is slightly lower than that of older teachers (0.36), indicating more consistency among younger teachers. This implies that age has minimal practical influence on positive

perception, as both groups view AI as beneficial for Physics teaching.

Test of Hypothesis

Null Hypothesis One: There is no significant influence of age on teachers' perception on application of Artificial Intelligence in teaching and learning of Physics in secondary schools in Ebonyi State.

Table 3: Independent t-test Analysis for Influence of Age on Teachers' Perception of AI Application in Teaching and Learning of Physics

Age	N	Mean	SD	Df	t-value	p-value	Decision
Below 35 years	42	74.12	6.05	88	1.84	0.07	Not Significant
35 years and above	48	71.96	8.22				

Table 3 shows independent t-test analysis for influence of age on teachers' perception of AI application in Physics. Teachers below 35 years had a mean perception score of 74.12 (SD=6.05) compared to 71.96 (SD=8.22) for those 35 years and above. Further analysis revealed that the mean difference was not statistically significant (t=1.84, df=88, p=0.07) at 0.05 level. Hence, the null hypothesis is not rejected. This confirms that age does not significantly influence perception of AI. This finding suggests that both digital natives and digital immigrants among Physics teachers share similar openness toward AI integration in Ebonyi State.

Discussion

The result showed that Physics teachers have positive perception on application of AI in teaching and learning of Physics. Teachers are ready to apply AI tools such as intelligent tutoring systems, PhET simulations powered by AI, and adaptive assessment in Physics instruction. The reason could be due to recent workshops on AI organized by different associations and exposure to virtual labs. The findings of the study aligns with Zulkarnain and Yunus (2023) and Wardat et al. (2023) who found positive perception of AI among teachers. However, it disagrees with Lai et al. (2020) who reported negative perception. Also, age does not have significant influence on teachers' perception, consistent with Ampong (2023) who found no age effect, but inconsistent with Kim and Kim (2022) who found age influences in favor of younger teachers.

Conclusion

The study concluded that Physics teachers in Ebonyi State have positive perception on application of AI in teaching and learning of Physics. Age does not significantly influence their perception. If teachers maintain strong positive perception, integration of AI in

Physics will improve instructional methods and may enhance students' achievement in Physics, especially in abstract topics requiring visualization and simulation.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. School administrators and Ebonyi State Government should ensure adequate provision of AI facilities, Physics virtual laboratories, and enabling environment.
2. Continuous professional development on AI integration should be organized for all Physics teachers regardless of age.
3. Curriculum planners should incorporate AI-based instructional strategies into Physics curriculum for secondary schools.

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