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Teachers' Readiness and Perception of AI Integration in Science Teaching: Implications for Innovation and Curriculum Reform in Anambra State

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Abstract
The study investigated secondary school teachers' readiness and perception of AI integration in teaching of science subjects in Anambra State. Three research questions and two hypotheses guided the study. A descriptive survey research design was employed to collect data from a sample of 80 secondary school science teachers. The instrument for data collection was adopted by the researchers, from the standard methods of "Technological Pedagogical Content Knowledge Framework"; developed by Mishra and Koehler (2006); "Teachers' Acceptance of AI Instrument"; developed by Guo, Shi and Zhai (2024); and "Unified Theory of Acceptance and Use of Technology Model" by Venkatesh, Thong and Xu (2012). The instruments have strong validation and reliability rating; making them credible instrument to use for this study. Data collected were analyzed using descriptive statistics (mean and standard deviation) to answer the research question, and inferential statistics (paired t test) for the research hypotheses. The study's findings provided insights into teachers' attitudes, knowledge, and skills in integrating AI in Science education, highlighting areas of strength and weakness. The results informed policymakers, educators, and stakeholders on how to support teachers in embracing AI-driven innovations and reforming the curriculum to meet the demands of a rapidly changing technological landscape. The study recommended among others that educational authorities should organize training programs to enhance teachers' knowledge and skills in integrating AI in Science. It was also recommended that the science curriculum should be restructured to give room for the incorporation of AI-driven innovations, ensuring that it aligns with the demands of a rapidly changing technological landscape and prepares students for future challenges.

Keywords: AI Integration, Innovation, Science Teaching, Teacher's readiness, Curriculum Reform

Introduction

Artificial Intelligence (AI) is rapidly transforming educational landscapes globally, offering tools such as adaptive learning systems, intelligent tutoring, automated assessments, and personalized instruction. Nowadays, artificial intelligence technology (AI), such as ChatGPT, in education is an undeniable reality, providing educators and students with unprecedented flexibility and accessibility (Mehdaoui, 2024). This and other technologies including machine learning (ML) and digital fabrication, as well as the increased connectivity and automation propagated by these different technologies led Schwab (2017) to describe the world as undergoing the Fourth Industrial Revolution. For instance, AI has been embedded in search engines of online consumer platforms and email (e.g., Google and Yahoo) to market items and promote consumerism (Verma, Sharma, Deb & Maitra, 2021). AI has also been applied to agriculture, finance, security, healthcare and education, especially science education.

Science education is a vital component of modern education, playing a crucial role in developing critical thinking, problem-solving, and analytical skills in students (Awosika, Austin, Ikusika, Mbaegbu and Okafor Agbala, 2025). As the world grapples with complex challenges such as climate change, pandemics, and technological advancements, science education has become more essential than ever (Awosika *et. al.,* 2025). According to Yacoubian (2018), science education is defined as the process of teaching and learning science, with the goal of developing scientific literacy and promoting critical thinking and problem-solving skills. Science education encompasses various disciplines, including biology, chemistry, physics, computer science, mathematics and an integration of all sciences in integrated science. These subjects are taught in basic levels during secondary

education; they began as introduction in junior secondary, and by senior secondary, a shift from simple towards some level of complexity occurs. Students at this senior secondary level all over the country already have personal access to technology and AI tools at large; this access may be affected by the socio-economic status of the students, yet these students continue to have access to these tools (Nuhu and Onojah, 2022). In the context of science education, these tools are particularly promising, as they can simulate complex scientific phenomena, foster critical thinking, and tailor learning to individual student needs (Papaneophytou & Nicolaou, 2025).

In Nigeria, studies have started to examine this emerging domain. For instance, there is emphasizes on the fact that AI-driven personalized learning and smart assessment tools can help bridge science learning gaps, boost digital literacy, and support entrepreneurial readiness among students George (2023). Notably, Lawal, Obeten, Olowookere, Lagbel, Elechi and Onyebuchi (2025) indicates that Biology teachers show high readiness to integrate AI into teaching practices, with preparedness correlating strongly with perceived benefits and access to resources. Despite these advances, teacher readiness and perceptions remain critical yet underexplored domains; especially in regions like Anambra State, where educational contexts may differ significantly from other states. Understanding local factors shaping AI integration is essential for meaningful innovation and curriculum reform.

While AI is recognized for its potential in enhancing science instruction, its actual integration in Nigerian classrooms remains limited. Teachers' readiness and perceptions; key drivers of effective adoption are under-researched in many states. Farhana, Khan and Chowdhury (2024) found results that are encouraging, with strong readiness among Biology teachers. However, broader surveys among Nigerian teacher educators reveal barriers such as inadequate infrastructure, limited training, and ethical concerns, even when readiness and positive attitudes are present; as seen in Sunday, Bassey, Essien, Udoh and Paul (2025) who highlight that although teachers recognize AI's potential in improving academic performance, their actual usage is significantly constrained by infrastructural limitations, insufficient training, and weak institutional support.

Since there are persisting unknown factors like:

1. How ready are science teachers to integrate AI into teaching?
2. What are their perceptions on both benefits and challenges?
3. What context-specific factors (e.g., infrastructure, professional development) influence their readiness and perceptions?

Addressing these questions will illuminate the conditions needed for effective AI adoption and essential for informed innovation and curriculum reform in the state. Answers to these questions are particularly beneficial to educational planners and policymakers at state and zonal levels as they will receive empirical insights into teacher readiness and infrastructural gaps, guiding effective resource allocation and training initiatives. It will also enable science teachers and administrators to understand prevailing perceptions, enabling targeted professional development and support for AI tools integration. In the same vein, curriculum developers will learn how AI can enhance science instruction and what support structures are necessary for successful rollout, and finally, academic researchers gain localized, empirical evidence of AI integration in education, contributing to broader Nigerian and global discourse.

Ultimately, the study aims to catalyze effective AI-driven instructional innovation, promote digital transformation, and guide curriculum reform anchored in teacher readiness and local context through looking into the following purposes;

1. To examine teachers' readiness for AI integration,
2. To explore teachers' perception of AI integration, and
3. To determine the implications of AI integration for innovation and curriculum reform.

Research Questions

1. What is the level of readiness among science teachers in Anambra State for integrating AI in their teaching practices?
2. What are the perceptions of science teachers in Anambra State regarding the integration of AI in STEM education?
3. What implications does AI integration have for innovation and curriculum reform in science education in Anambra State?

Research Hypotheses

1. Hypothesis 1: there is no significant relationship in the mean readiness scores for AI integration among science teachers with their perception of AI integration.
2. Hypothesis 2: there is no significant relationship between science teachers' perception of AI integration and their attitude towards innovation in curriculum design.

Method

The study adopted descriptive survey design. The population of the study consists of all the science teachers in the public secondary schools of Anambra State. Twenty (20) schools were randomly selected, and eighty (80) teachers were randomly selected from the Science Education Department in each of the sampled schools. The teachers, made up of 27 males and 53 females make up the research participants.

The instrument for data collection was questionnaire adopted by the researchers, from the standard methods of "Technological Pedagogical Content Knowledge Framework"; developed by Mishra and Koehler (2006); "Teachers' Acceptance of AI Instrument"; developed by Guo, Shi and Zhai (2024); and "Unified Theory of Acceptance and Use of Technology Model" by Venkatesh, Thong and Xu (2012). The instruments have strong validation and reliability rating; making them credible instrument to use for this study. The data were collected through a dissemination of the link containing the questionnaire by the researchers across the sampled schools. Each item on the questionnaire was responded to by the research participants according to the 4 – point Likert scale of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD). The data collected were analysed using mean and standard deviation to answer the research questions; and independent t-test answered the research hypotheses.

RESULTS

Table 1: level of readiness among science teachers in Anambra State for integrating AI in their teaching practices

S/N	Statement	Mean	SD	Remark
1	I know how to troubleshoot technical problems with digital tools	3.02	.83	Accepted
2	I am familiar with different types of AI-powered tools	2.83	.87	Accepted
3	I can use digital tools to create multimedia	2.81	.83	Accepted
4	I can effectively use technology to support my teaching	3.24	.89	Accepted
5	I stay current with emerging technology	3.08	.81	Accepted
6	I can design lessons that integrate AI-powered tools in a way that enhances students learning	2.94	.86	Accepted
7	I am able to use AI-powered tools to support student centered learning	2.94	.85	Accepted
8	I can use digital tools to assess student learning and provide feedback	2.91	.86	Accepted
9	I can effectively integrate technology into my teaching practices	3.05	.78	Accepted
10	I can troubleshoot technical issues that arise during lessons	2.83	.92	Accepted
	Grand Mean	2.97	.13	Accepted

Table 1 shows the level of readiness among science teachers in Anambra State for integrating AI in their teaching practices. Both mean of means and means of individual questions suggest high level of readiness for integrating AI in their teaching practices. This is evident in every other question as well as the mean of means in the agreement margin of 2.50. The standard deviation also shows very little spread, with a .13 score suggesting that the responses are clustered (unison).

Table 2: perceptions of science teachers in Anambra State regarding the integration of AI in STEM education

S/N	Statement	Mean	SD	Remark
1	Using AI-powered tools in my teachings will improve students learning outcome	3.30	.83	Accepted
2	AI-powered tools will help me to be more productive in my teaching	3.20	.91	Accepted
3	AI-powered tools will enable me to provide more personalized feedback to students	3.19	.84	Accepted
4	AI-powered tools will enhance my teaching effectiveness	3.25	.77	Accepted
5	AI-powered tools will increase student's engagement	3.13	.90	Accepted

6	I find AI-powered tools easy to use	3.06	.86	Accepted
7	I am able to learn how to use ne AI-powered tools quickly	3.06	.86	Accepted
8	I think that AI-powered tools are user friendly	3.20	.80	Accepted
9	I can easily navigate AI-powered tools	3.00	.94	Accepted
10	I can troubleshoot issues with AI-powered tools	2.85	.86	Accepted
11	I intend to use AI-powered tools in my teaching in the future	3.31	.80	Accepted
12	I plan to recommend AI-powered tools to my colleagues	3.30	.83	Accepted
13	I will try to use AI-powered tools in my teachings as much as possible	3.20	.80	Accepted
14	I will encourage others to use AI-powered tools	3.19	.94	Accepted
15	1 will prioritize using AI-powered tools in my teaching practices	3.00	.90	Accepted
	Grand Mean	3.15	.13	Accepted

Table 2 shows the perceptions of science teachers in Anambra State regarding the integration of AI in STEM education. Both mean of means and means of individual questions suggest positive perceptions of science teachers in Anambra State regarding the integration of AI in STEM education. This is evident in every other question as well as the grand mean in the agreement margin of 2.50. The standard deviation also shows very little spread, with a .13 score suggesting that the responses are clustered (unison).

Table 3: Implications of AI integration for innovation and curriculum reform in science education in Anambra State

S/N	Statements	Mean	SD	Remark
1	I think that using AI-powered tools will help me improve students learning outcome	3.17	.88	Accepted
2	Using AI-powered tools will improve my productivity as a teacher	3.15	.90	Accepted
3	AI-powered tools will enable me to provide more effective feedback to students	3.05	1.02	Accepted
4	AI-powered tools will enhance my teaching effectiveness	3.20	.91	Accepted
5	AI-powered tools will increase student's achievement	2.88	1.07	Accepted
6	I think that using AI-powered tools will be easy for me	3.14	.84	Accepted
7	I expect that learning to use AI-powered tools will be straightforward	3.01	.95	Accepted
8	I think that AI-powered tools will require minimal effort to use	2.90	.92	Accepted
9	I can easily learn to use new AI-powered tools	3.14	.94	Accepted
10	I can use AI-powered tools without extensive training	2.81	.98	Accepted
11	My colleagues think that I should use AI-powered tools in my teaching	2.81	.84	Accepted
12	My school administrators encourage me to use AI-powered tools	2.53	1.03	Accepted
13	I see my peers using AI-powered tools in their teachings	2.29	1.07	Rejected
14	My school culture supports the use of AI-powered tools	2.43	1.06	Rejected
15	I feel pressure from others to use AI-powered tools	2.53	.95	Accepted
	Grand Mean	2.87	.30	Accepted

Table 3 shows the implications of AI integration for innovation and curriculum reform in science education in Anambra State. Both mean of means and means of individual questions suggests unified implication in the perception of the respondents. While every other question is in the agreement margin of 2.50, only questions about current use by peers and school culture suggest disagreement. The standard deviation also shows little spread, with a .30 score suggesting that the responses are clustered (unison).

Test of Statistical Hypotheses

Hypothesis 1: There is no significant relationship in the mean readiness scores for AI integration among science teachers with their perception of AI integration.

Table 4: paired sampled t test analysis on mean readiness scores for AI integration among science teachers with their perception of AI integration

Subjects	N	MEAN	SD	T- CAL.	DF	α	Sig
Readiness for AI integration	10	2.97	.13	-3.178	9	.05	.011
Perception of AI integration	15	3.15	.13		14		

Data presented in Table 4 shows that the sig-value of .011 is greater than 0.05 alpha level. Hence, the hypothesis was not rejected at 0.05 alpha level of significance and, 9 and 14 degrees of freedom. This implies that there is no significant relationship in the mean readiness scores for AI integration among science teachers with their perception of AI integration.

Hypothesis 2: There is no significant relationship between science teachers' perception of AI integration and their attitude towards innovation in curriculum design.

Table 5: paired sampled t test analysis on science teachers' perception of AI integration and their attitude towards innovation in curriculum design

Subjects	N	MEAN	SD	T- CAL.	DF	α	Sig
Perception of AI integration	15	3.15	.13	3.294	14	.05	.005
Attitude towards innovation in curriculum design	15	2.87	.30		14		

Data presented in Table 5 shows that the sig-value of .005 is less than 0.05 alpha level. Hence, the hypothesis was rejected at 0.05 alpha level of significance and 14 degree of freedom. This implies that there is a significant relationship between science teachers' perception of AI integration and their attitude towards innovation in curriculum design.

Discussion of the Findings

The study found that secondary school science teachers in Anambra State showed a high level of readiness and a positive perception toward integrating AI in their teaching practices. The mean of means for both readiness and perception scores were above the agreement margin of 2.5, at 2.97 and 3.15, respectively, indicating a unified positive response from the teachers. This aligns with (Farhana, Khan and Chowdhury, 2024) and (Lawal, Obeten, Olowookere, Lagbel, Elechi and Onyebuchi, 2025) suggesting that teachers recognize the potential of AI to improve academic performance and enhance learning outcomes. The findings also revealed a strong correlation between the teachers' readiness for AI integration and their perception of it. This suggests that as teachers' readiness and familiarity with AI increase, their positive perceptions also grow, and vice-versa.

The study also investigated the implications of AI integration for curriculum reform and innovation. The results indicated that while teachers have a positive perception of AI's potential to improve productivity and effectiveness, they are not currently seeing widespread use of AI among their peers or strong support from their school's culture. The mean scores for questions related to peer use and school culture were below the agreement threshold, at 2.29 and 2.43, respectively. This suggests that despite individual readiness and positive attitudes, a lack of infrastructural support, limited training, and weak institutional backing remain significant barriers to the actual implementation of AI in the classroom. This finding is consistent with (Sunday, Bassey, Essien, Udoh and Paul, 2025) that highlights how infrastructural limitations and insufficient institutional support constrain the actual use of AI by teachers, even when they have a positive attitude toward it. The study's results also show a significant relationship between teachers' perception of AI integration and their attitude toward curriculum innovation. This implies that a positive perception of AI integration can drive a positive attitude toward reforming the curriculum to incorporate AI-driven innovations.

Conclusion

The study concludes that secondary school science teachers in the Anambra State are prepared and have a positive outlook regarding the integration of AI into their teaching practices. Their readiness and perceptions are significantly related, with a positive view of AI influencing their attitude toward curriculum reform and innovation. However, the study also highlights significant systemic challenges, namely the lack of institutional support and widespread peer adoption within the schools. This indicates that while teachers are individually ready to embrace AI, the necessary supportive environment for effective, widespread implementation is not yet fully in place. To successfully integrate AI, it's crucial for policymakers and educational authorities to address these infrastructural and institutional gaps.

Recommendations

Based on the findings, the study offers the following recommendations:

1. Organize Training Programs: Educational authorities should organize training programs to improve teachers' knowledge and skills in AI integration in science education. This will further enhance their readiness and positive perceptions, which in turn will drive curriculum reform.
2. Restructure the Science Curriculum: The science curriculum should be restructured to accommodate AI-driven innovations. This ensures that the curriculum aligns with the demands of a changing technological world and prepares students for future challenges.
3. Address Infrastructural Gaps: Policymakers and administrators must address the infrastructural limitations and provide adequate institutional support for AI tools. This includes ensuring that teachers have the necessary resources and a supportive school culture to effectively implement AI in their classrooms.

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