

Teachers' Awareness and Application of Artificial Intelligence for Teaching Science Education in Kaduna State College of Education, Gidan Waya, Nigeria

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Abstract

The paper aimed to assess academic staff's level of awareness and application of artificial intelligence (AI) for teaching Science Education in Kaduna State College of Education, Gidan Waya, Nigeria. Descriptive survey research design was used for the study. Three research questions guided the study. The population of the study comprised of all 135 teaching staff in School of Science Education, Kaduna State College of Education, Gidan Waya. Sample of 70 teaching staff were randomly selected across all departments using simple random sampling. Artificial Intelligence Science Education Teachers' Awareness Questionnaire (AISETAQ) was used for data collection. The instrument was subjected to face validity by three experts. The internal consistency reliability method was used and Cronbach Alpha reliability was applied which yielded 0.78. Data were analysed using frequency count and simple percentage. Findings showed that although most academic staff were aware of AI, very few applied AI in teaching. Result also showed that several factors such as lack of knowledge about AI and AI tools, inability to download or access AI tools, poor network, inadequate electricity, lack of adequate gadgets for applying AI in teaching were some militating factors affecting the application of AI in teaching. The study recommended among others; workshops and seminars be conducted by government from time to time to update academic staff with trends on the application of AI in teaching. Government should provide sufficient gadgets at departmental levels for effective teaching using AI.

Key words: Teachers' Awareness, AI, Application, Science Education

Introduction

Awareness is a concept referring to having a clear understanding or recognition of its presence or importance. In everyday terms, it involves being informed about a particular issue or development. Abdulrafiu, Makinde, Sakariyahu, and Apo (2024) describe awareness as the conscious recognition of both the existence and value of a concept or tool. When it comes to integrating Artificial Intelligence (AI) into teaching, educators must first be familiar with what AI entails before they can effectively incorporate it into their classroom practices. AI refers to a branch of computer science focused on creating machines and systems capable of performing tasks

that typically require human intelligence—such as reasoning, learning from experience, and making decisions. Hermansyah et al. (2023) explain that AI involves simulating these human-like cognitive processes through computer systems, especially when handling data that is too vast or complex for humans to process on their own. Although AI has made impressive strides in various aspects of education, its specific role in science teaching still lacks comprehensive research. There remains a pressing need for detailed, evidence-based exploration into how AI can improve the delivery and understanding of science content in classrooms. Without this deeper insight, educators, policymakers, and school

administrators risk making decisions based on limited or fragmented knowledge, potentially missing out on valuable opportunities to enrich science education using AI tools (Pima, 2019). In response to this gap, the present review aims to gather and analyze available research to better understand the influence of AI on science teaching and learning.

Artificial Intelligence in Education (AIEd) is an emerging and dynamic field that blends AI technologies with educational practices to transform how teaching and learning take place. This innovative integration is especially gaining momentum in science education, where educators and researchers are increasingly exploring how AI can reshape classroom experiences (Chiu et al., 2023; Gonzalez et al., 2017). As interest in the broader educational applications of AI grows, so does its relevance in specific subject areas like science. Popenici and Kerr (2017) examined how AI is influencing the educational landscape, particularly within higher education institutions. Their work delved into the ways intelligent systems are altering how students learn and how educators deliver instruction. Their findings provide important perspectives on how science education can adapt to and benefit from AI tools. Similarly, Zawacki-Richter and colleagues (2019) carried out a comprehensive review of AI use in tertiary education. Their study emphasized the critical function that teachers serve in the successful implementation of AI in the classroom. One of their key takeaways was the necessity of understanding teachers' attitudes, needs, and readiness when it comes to adopting AI technologies in teaching environments. This highlights the importance of supporting educators through training and resources as schools and universities move toward AI-driven instruction.

Science education refers to the process of teaching scientific concepts, principles, and methods to learners of all ages, whether they are schoolchildren, college students, or members of the wider public. According to Paul (2020), it involves more than just passing on scientific facts—it encompasses the scientific method, elements of social science, and instructional strategies aimed at helping learners understand how science operates within society. By focusing on building strong scientific ideas and fostering an appreciation of how science works in real-world contexts, science education plays a vital role in nurturing the knowledge and skills learners need to engage with scientific issues. The primary aim of science education goes beyond imparting factual knowledge; it seeks to cultivate a population that is scientifically informed and able to

apply critical thinking in making decisions rooted in scientific reasoning. This philosophy supports the vision behind the “Science for All” initiative, which promotes inclusive science education for every learner, not just those pursuing careers in scientific fields (Almasri, 2021). Through engaging in experiments, learning scientific theories, and applying scientific procedures, students sharpen their analytical skills and enhance their scientific literacy (Alharbi et al., 2022). In today’s world, where STEM careers are increasingly important, building students’ curiosity and foundational knowledge in science has become essential.

The integration of Artificial Intelligence (AI) offers new avenues to enrich science education. By introducing AI-driven tools, learning can become more interactive, personalized, and accessible for diverse groups of students. AI supports experiential learning by enabling simulations and virtual experiments, which can make complex concepts easier to grasp and reduce the need for expensive lab equipment. As Wahyoo et al. (2019) point out, these virtual labs allow students to safely engage in scientific practice and explore scenarios that might not be possible in traditional classroom settings. Despite these advantages, some challenges remain. While AI-based simulations offer convenience and innovation, they may fall short in replicating the physical, hands-on experiences that are crucial for certain types of learning. Tang and Cooper (2024) argue that the absence of tactile engagement in virtual experiments could limit students’ understanding in cases where direct interaction with materials is essential. Nevertheless, the continuous evolution of AI holds exciting potential to reshape science education and prepare students for a future where science and technology are deeply intertwined.

With the integration of Artificial Intelligence (AI) in education, teachers now have the opportunity to move beyond conventional teaching models that treat all students the same. Instead, they can offer more personalized and interactive learning experiences tailored to each student’s unique needs and pace. This shift allows learners to engage more meaningfully with the content and receive support that aligns with their individual learning journeys. However, as Kafyulilo et al. (2018) point out, the success of AI-driven personalization depends largely on the quality and diversity of the data used to train these systems. If the data is flawed or biased, it can unintentionally reinforce existing inequalities in the classroom. Still, one of the key advantages of using AI in science education is its ability to provide immediate, tailored feedback to students. This helps

them quickly identify and correct misunderstandings or knowledge gaps, particularly in complex scientific topics (Mavroudi et al., 2018). Moreover, AI tools can support teachers by tracking students' progress in real time. This makes it easier to identify learners who may need additional help and to design targeted interventions that address specific challenges. According to Pima (2019), AI also opens the door to creating dynamic and immersive learning environments that appeal to a variety of learning styles, making science education more inclusive and engaging. As technology continues to evolve, the role of AI in science classrooms is expected to expand. Park et al. (2023) emphasize that these innovations have the potential to significantly reshape how science is taught and experienced, making learning more effective, stimulating, and accessible for students across different educational levels.

One of the key advancements brought by Artificial Intelligence (AI) in science education is its ability to enhance exploratory learning through the use of virtual laboratories and simulations (Mahmoud, 2020). These AI-driven tools make it possible to replicate intricate scientific experiments—some of which may be too dangerous, expensive, or impractical to carry out in traditional classroom settings. By immersing students in these simulated environments, learners are given the chance to explore different scenarios, manipulate variables, and observe outcomes, which strengthens their grasp of scientific ideas (Ibanez et al., 2018). This not only deepens engagement but also helps to bridge educational inequalities by giving a broader range of students access to high-quality science experiences.

In addition, these technologies allow educators to incorporate diverse datasets into the curriculum, exposing students to real-world scientific problems and authentic data analysis, which enriches their learning experience and better prepares them for the challenges of modern science (Holmes et al., 2023). Despite these advantages, several factors continue to hinder the widespread adoption of AI in science classrooms. While many studies have explored what influences teachers' use of AI, the findings often point in different directions. One common issue is the lack of access to AI tools and infrastructure, which creates a significant barrier to implementation (Kafyulilo et al., 2018; Pima, 2019). Additionally, many teachers report not having the necessary training or technical support to confidently use these technologies in their teaching (Mahmoud, 2020). Others find AI systems too complex or intimidating to integrate into their lessons (Hong et al., 2022). Teachers' confidence in their computer

skills, often referred to as computer self-efficacy, also plays a major role in whether or not they adopt AI-based tools (Tang & Cooper, 2024). Furthermore, without sufficient awareness of what AI can do and how it can be used in the classroom, teachers may not consider it a viable option (Lawrence & Tar, 2018). Given these challenges, this study aims to investigate how much academic staff currently know about the role and potential of AI in science teaching, with the goal of identifying awareness levels and the factors influencing their willingness or reluctance to adopt such technologies.

Statement of the Problem

In recent years, there has been growing advocacy for the integration of Artificial Intelligence (AI) into educational systems—not as a substitute for teachers, but as a supportive tool to enhance both teaching and learning. Numerous studies and professional workshops have focused on how AI can be applied specifically within science education. Building on this foundation, the present study aims to explore how this knowledge is being implemented in science classrooms and its potential benefits. While AI has been successfully adopted in various areas of education, its specific contribution to science teaching still requires in-depth examination. There remains a need for systematic research that critically analyzes how AI supports, challenges, and transforms science education. Without such evidence, teachers, school administrators, and policymakers may be forced to make decisions based on incomplete or superficial insights—potentially missing opportunities to improve student learning outcomes through AI integration. To address this gap, the current study conducts a structured review of literature to evaluate and synthesize the role of AI in science instruction. It aims to offer clear evidence on how AI is impacting the field and where more focused attention is needed.

In the context of Nigeria, the education system has long struggled with issues related to curriculum implementation. Although well-designed curricula exist—particularly in science education, which emphasizes active student participation—actual classroom execution often falls short. By embedding AI tools into science teaching, educators may be better equipped to support student engagement and academic achievement. However, for this to happen effectively, science teachers must possess the necessary skills and competencies to use AI in their classrooms. This makes it essential to investigate not only the potential impact of AI on science learning but also the various factors that

influence whether and how teachers adopt these technologies. The present research responds to this need by examining both the effectiveness and practical considerations of using AI in science education.

Purpose of the Study

The paper aimed to examine the impact of Artificial Intelligence (AI) as a driven force in science education. Specifically, the study investigates:

1. Academic staff's level of awareness of AI for teaching science education.
2. The level of application of AI in teaching science education.
3. The challenges encountered in utilizing AI for teaching and learning of science education?

Research Questions

The study is guided by the following research questions:

1. To what extent are academic staff aware of the use of AI for teaching science education?
2. What is the level of application of AI for teaching science education?
3. What are the challenges encountered in utilizing AI for teaching and learning of science education?

Method

The study employed the descriptive survey research. This is because it enabled researchers to gather data from a large population. The study is guided by three research questions. The population of the study is made up of all 135 lecturers comprising of 70 females and 65 males. Furthermore, simple random sampling was used to obtain a sample of 70 lecturers across the seven departments, namely: Chemistry, Physics, Biology, Integrated Science, Physical and Health Education, Computer Science, and Mathematics Education. The Instrument for data collection is Artificial Intelligence Science Education Teachers' Awareness Questionnaire (AISETAQ). The instrument was developed by the researchers and is made up of four sections. Section 'A' consist of the respondents' demographic information, Section 'B' consists of 5 item statements verifying the respondents' knowledge of AI. Section 'C' consists of 8 item statements which examine available materials for the application of AI in teaching science education. Section 'D' consists of 8 item statements which examine possible challenges in the application of AI for teaching science education among academic staff. The instrument was subjected to face validation by three experts from the Department of Integrated Science and Mathematics KSCOE, Gidan Waya. The internal consistency reliability method was used and Cronbach Alpha reliability was applied that yielded 0.78 which made the instrument reliable. The data collected from the respondents were analyzed using frequency count and simple percentage.

Table 1: Population and Sample Distribution of Academic Staff for the Study.

S/No	Department	Population	Sample
01	Integrated Science	15	10
02	Chemistry	22	10
03	Physics	17	10
04	Biology	28	10
05	PHE	15	10
06	Computer Science	24	10
07	Mathematics	14	10
	Total	135	70

Source: Heads of Departments Office, 2024/2025 academic session, School of Secondary Education (Science Programmes) Kaduna State College of Education, Gidan Waya.

Results

Table 2: Percentage rating of academic staff knowledge of AI for teaching science education.

S/No	Item Statement	Yes		No	
		f	%	f	%
1.	Are you familiar with AI for teaching?	17	(24.28)	53	(75.72)
2.	Are you aware of AI tools for teaching?	0	(0.0)	70	(100)
3.	Have you used AI?	0	(0.0)	70	(100)

4. Given the opportunity will you like using AI to teach?	70	(100)	0	(0.0)
5. Have you ever attended a training on using AI to teach?	15	(21.42)	55	(78.57)

Table 1 shows that all the respondents 70 (100%) are not currently using AI to teach nor using AI to give and mark assignments. Even though 17 (24.28%) respondents are familiar with AI tools for teaching.

The table shows that all the respondents 70 (100%) indicates interest if given the opportunity to use AI for teaching, only 15 (21.42%) have ever attended training on using AI to teach.

Table 3: Percentage rating of available materials for the application of AI in teaching and learning science education.

S/No	Item Statement	Yes f	%	No f	%
1.	Do you have a personal computer/laptop?	70	100	0	0.0
2.	Is there computer lab in the department/school?	0	0	70	100
3.	Is the lab equipped with adequate computers?	0	0	70	100
4.	Do you have a personal projector?	0	0	70	100
5.	Are there projectors in the department/school?	0	0	70	100
6.	Are the projectors adequate to use?	0	0	70	100
7.	Do you use computer/projector?	0	0	70	100
8.	Is there available electricity in the department/school for using the computer/projector?	0	0	70	100

Table 3 indicated that all 70 (100%) academic staff have personal computer/laptop while none has personal projector. The table also shows that there are no available materials such as computers, projectors

and electricity in the department/school for the application of AI for teaching and learning of science education as indicated by the respondents.

Table 4: Percentage rating of academic staff perceived challenges in using AI for teaching science education.

S/No	Item Statement	Yes		No	
		f	%	f	%
1.	Lack of adequate training on how to source and apply AI tools for teaching.	70	100	0	0.0
2.	Lack of technicians to manage AI tools	42	60	28	40
3.	Lack of basic knowledge and usage of AI-based teaching methods.	62	88.57	8	11.43
4.	Lack of network for downloading AI materials	20	28.57	50	71.43
5.	Inadequate supply of electricity	70	100	0	0.0
6.	Lack of funding for supplies and repairs of AI tools	70	100	0	0
7.	AI tools are difficult to maintain and purchase.	64	91.43	6	8.57
8.	Downloading AI materials consumes money	70	100	0	0

Table 4 shows the following as the major challenges in using AI in teaching: 70 (100%) respondents indicated that lack of adequate training on how to source and apply AI tools for teaching, 42 (60%) lack of technicians to manage AI tools, 62 (88.57%) lack of basic knowledge and usage of AI-based teaching methods, 20 (28.57%) lack of network for downloading AI materials, 70 (100%) inadequate supply of electricity, 70 (100%) lack of funding for supplies and repairs of AI tools, 64 (91.43%) AI tools are difficult to maintain and purchase and 70 (100%) indicated that downloading AI materials consumes money.

Discussion of Findings

Results in Table 1 revealed that all the respondents 70 (100%) are not currently using AI to teach nor to give and mark assignments. This could be as a result of lack of basic knowledge on how to source and apply AI tools for teaching. This finding aligns with the observations of Lawrence and Tar (2018), who noted that many teachers are unaware of the existence and potential of AI-based teaching tools, which hinders their willingness or ability to use them. Mahmoud (2020) also highlighted that a lack of proper training and technical support leaves teachers ill-equipped to implement AI effectively in their classrooms. Similarly, Hong et al. (2022) reported that some educators perceive AI technologies as

overly complex or intimidating, which discourages them from adopting these tools in their teaching practices.

Table 3 shows that there are no available materials such as computers, projectors and electricity in the department/school for the application of AI for teaching and learning of science education. This finding agreed with the findings of Dai, (2023) that lack of AI resources is a factor affecting the use of AI in teaching.

Table 4 indicated the following as the major challenges in using AI in teaching: lack of adequate training on how to source and apply AI tools for teaching 70 (100%), 42 (60%) lack of technicians to manage AI tools, 62 (88.57%) lack of basic knowledge and usage of AI-based teaching methods, 20 (28.57%) lack of network for downloading AI materials, 70 (100%) inadequate supply of electricity, 70 (100%) lack of funding for supplies and repairs of AI tools, 64 (91.43%) AI tools are difficult to maintain and purchase and 70 (100%) indicated that downloading AI materials consumes money. This is in agreement with the findings of Kafyulilo et al. (2018); Dai, (2023); Hong et al. (2022); Zhai, He, and Krajcik (2022).

Conclusions

Artificial Intelligence holds great promise for enhancing science education by significantly

transforming how teaching and learning take place. With AI tools, educators can better understand individual student learning styles, strengths, and needs—allowing for content to be tailored in ways that support personalized learning experiences. This adaptive approach enables students to grasp scientific concepts more effectively and at their own pace, making learning both efficient and enjoyable. Additionally, AI-driven data analysis offers valuable insights for science teachers, helping them track student performance more accurately and identify areas where additional support may be needed to ensure academic success.

Recommendations

Based on the findings, the study recommended the following:

1. There should be workshop and seminar to enlighten teachers on using AI to teach, give, and mark assignments.
2. There should be adequate and functional computer labs equip with computers, projectors and standby generator or uninterrupted electricity at the departmental and school level for staff and students to use.
3. Workshops and seminars should be organized by government from time to time to update academic staff on the need to utilize AI tools in teaching. During the workshop/seminar, staff can also learn basic knowledge how to source, organize and use AI-based teaching methods.

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