



Awareness, Access, and Use of Artificial Intelligence Tools Among Chemistry Teachers in Abeokuta Metropolis, Ogun State

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Abstract

The research investigated the degree to which chemistry teachers in Abeokuta Metropolis, Ogun State, are aware of, have access to, and make use of artificial intelligence (AI) tools. Three research questions and three hypotheses served as the study's guide. The design of the study used in this research was a survey that is descriptive. The population was made of 166 chemistry educators from the public secondary schools with a purposive sample of 64 teachers (30 males, 34 females) from 60 senior secondary schools. Teachers' awareness, accessibility and utilization of artificial intelligence for teaching chemistry (TAAUAITC) was the instrument used to collect the data which was modified from Enebechi et al. (2024) and Zudonu et al. (2024). Three subject-matter experts validated the instrument. Using Cronbach's Alpha, the TAAUAITC instrument's internal consistency reliability was found to be 0.84. The descriptive statistics were used to answer the study questions, particularly standard deviation and mean, and the hypotheses were examined at the 0.05 significance level using a t-test. The findings showed that chemistry teachers were not very aware of, had limited access to, or used AI tools. The awareness, availability, and use of artificial intelligence tools by chemistry teachers were not significantly impacted by gender. Among other things, it was suggested that the government should provide in-service and, on the job, artificial intelligence training for the chemistry teachers for increased teachers' awareness, accessibility and utilization in their instruction and learning.

Keywords: Awareness, Accessibility, Utilization, Artificial Intelligence, Chemistry Teachers,

Introduction

Artificial intelligence (AI) involves building computer networks that can carry out activities that normally need human intellect, which includes reasoning and learning. Problem-solving, and perception. Artificial intelligence systems can examine and evaluate information, make decisions and take actions based on that analysis, often with the goal of improving efficiency, accuracy or making choices. Applications for AI are numerous and include virtual assistants and image recognition to predict analytics and autonomous vehicles.

In recent times, educational systems around the world have progressively integrated tools for the use of artificial intelligence (AI) to enhance quality of instruction and learning. For instance, AI is incorporated into curriculum design, adaptive learning systems, and virtual labs, enabling teachers to engage students through more engaging and participatory experiences (Kukulka & Hulme, 2020). Although artificial intelligence (AI) is widely recognized as a transformative force in education,

there are still instances where educators and learners exhibit ineffectiveness and unfavourable views toward the use of AI to improve the effectiveness, individualization, and interest of education (Kautz, Etzioni & Mooney 2021, Akgun & Greenhow, 2022). This is shown in educational settings which are still shaped by issues such as lack of trust, high costs, and resistance to adopting effective technological tools that could enhance teaching and learning for both educators and students. Artificial intelligence has become a catalyst for change across numerous industries, including education, significantly influencing how chemistry is taught and learned at both secondary and tertiary levels (Aguolu, 2019).

The use of artificial intelligence is framed in chemistry instruction and education within a theoretical context is crucial for directing the study of chemistry teachers' consciousness, access, and use of AI-powered instruments in Abeokuta Metropolis, Ogun State. The theoretical framework

serves as a basis for examining how these variables—awareness, accessibility, and utilization—interact within the area of chemistry instruction. This research adopts Davis developed the Technology Acceptance Model (TAM) in 1989, a well-known model for exploring the factors that affect technology adoption in educational environments. According to TAM, key factors influencing technology acceptance include Perceived Ease of Awareness (PEOA), Perceived Accessibility (PA), and Perceived Utilization (PU).

Perceived Ease of Awareness (PEOA): This describes the extent to which a teacher understand and recognize the capabilities, benefits and limitations regarding artificial intelligence tools in improving the effectiveness of teaching and learning outcomes in chemistry can be enhanced through the application of artificial intelligence instruments. Educators are more prone to view these instruments as beneficial if they help clarify intricate chemical ideas, deliver interactive models, or support learning experiences that are tailored to each student.

Perceived Accessibility (PA): This refers to the degree to which teachers can access and willing to adopt AI resources in their instructional strategies. Teachers may be reluctant to adopt AI tools if they are too complicated, demand extensive training, or require advanced technological infrastructure.

Perceived Utilization (PU): The idea of perceived utilization of artificial intelligence by teachers pertains to the extent which educators think AI-powered tools are useful and effective in enhancing instructional strategies and the learning objectives of learners in chemistry.

AI integration into science instruction is becoming a powerful catalyst for enhancing teaching and learning in schools. These artificial intelligence tools can improve teaching and educational opportunities, especially in subject like chemistry that require complex problem-solving and critical thinking. Some of the promising possibilities offered by AI incorporate individualized experiences, modelling of intricate chemical processes, and immediate evaluation and input. Olaogun and Oyediran (2023) examined the rapid impact of AI across different sectors, including education, and found that the general perception of AI in education is largely positive. The same is true for Sun, Yang, and Chen (2021) who demonstrated that artificial intelligence can support teaching chemistry through virtual laboratories, simulation tools, and AI-based platforms that simplify intricate concepts such as molecular structures, chemical reactions, and equations. However, the realization of these advantages is often hindered by infrastructural

deficiencies and inadequate teacher training—challenges that are particularly pronounced in less developed countries with limited classroom technology.

In addition, the effectiveness utilizing AI resources in the teaching of chemistry is dependent upon various factors, including teachers' knowledge of, access to, and use of these tools. These led Faruku (2024), to examine secondary school chemistry teachers' understanding and views on how chemistry is taught and learned in Sokoto State using artificial intelligence. Findings revealed low level of teachers' awareness and that teachers' perception of using AI as a teaching and learning tool for chemistry in Sokoto State's secondary schools was high. Research carried out by (Alimi et al., 2021), revealed low level of University students' knowledge, accessibility, and utilization of AI in Kwara State's educational system. Enebechi et al., (2024), reported low level of understanding and utilizing artificial intelligence materials for biology education in Enugu State's senior secondary schools. Zudonu et al., (2024), revealed low level of chemistry teachers' artificial intelligence utilization and accessibility in secondary schools in River State.

Furthermore, Dergunova et al. (2022) examined the level of knowledge about AI among students of engineering and revealed that they possessed a strong understanding of artificial intelligence. Similarly, Owolabi et al. (2022) investigated the awareness and preparedness of Nigerian polytechnic students for integrating AI into library systems. The findings indicated that, while students recognized the importance of acquiring fundamental knowledge regarding computers to be more pertinent In the present day, they had learnt about artificial intelligence (AI) in the context of libraries orientation sessions and were aware of its application in library operations. According to a 2019 study by Kuo et al., students' concerns were expressed about the precision and reliability of AI technologies as well as the potential for them to ultimately take the place of human educators. According to Adebayo (2023), while the Nigerian government is striving to integrate Information and Communication Technology (ICT) into the education sector, the extent to which AI has been adopted in secondary schools—particularly in Ogun State—remains unclear.

In addition, as far as the researchers are aware and the literature presently in circulation, little is known about how gender disparities in secondary school settings—particularly within Abeokuta Metropolis—impact teachers' awareness, accessibility, and utilization of artificial intelligence

(AI) tools. Gender, according to Kaufman et al. (2023), is a social construct that shapes standards and responsibilities based on what is seen suitable for people from their assigned sex at birth. The societal assignment of roles and expectations to males and females has led to misconceptions, including the belief that science is inherently masculine. This perception is further reinforced by the tendency of some science educators to present subjects such as physics and chemistry with a male-dominated perspective, often steering female students toward subjects like agricultural science, biology, and home economics, which are thought to be more "feminine-friendly" fields of study (Nnorom, 2015). Furthermore, Adeneye and Adelege (2011) pointed out that both men and women tend to differ in academic interests, subject choices, extracurricular activities, and academic performance. But this runs counter to the results of Alimi et al.'s (2021), which revealed that in Kwara State, both male and female university students demonstrated similarly low levels of awareness in relation to using AI tools for learning, with no significant gender-based differences. Enebechi et al. (2024), also reported that there was low and no significant difference on knowledge of AI-based biology learning resources among male and female students at Enugu State's secondary schools.

According to Zudonu et al., (2024), there was low and not much difference on the idea of the accessibility of AI resources and technologies among chemistry teachers in River State. Additionally, studies showed that, in spite of AI's benefits, teachers are reluctant to integrating it into classroom instruction (Yungei & Han, 2022). This results in teachers and students' unaware, accessibility and utilization of some of the AI learning tools in learning. Therefore, this study's objective is to ascertain chemistry teacher's awareness, accessibility, and application of artificial intelligence (AI) tools among chemistry teachers in Abeokuta Metropolis, with focus on identifying the influence of gender.

Statement of the Problem

After artificial intelligence (AI) was introduced, various scholars and professionals have embraced it as a means of solving problems. Incorporating AI tools into education holds significant promise for improving both teaching and learning processes, improve students' outcomes and increase teachers' productivity particularly in subject like chemistry. However, despite the growing availability of AI tools, there is a concern that many chemistry teachers may not be aware of, have access to or

effectively make use of these resources in their instructional strategies. Thus, this study's objectives determine the extent of chemistry teachers' knowledge, availability, and application of artificial intelligence (AI) tools in Abeokuta Metropolis, Ogun State. Also, is there a possibility of differences in the knowledge, availability, and application of AI tools for teaching chemistry based on gender?

Research Questions

1. What is the degree of awareness among chemistry teachers on the use of AI tools in teaching?
2. What is the degree of chemistry teachers' accessibility to the application of AI tools in teaching?
3. To what extent do chemistry teachers utilize AI resources in their instructional strategies?

Hypotheses

1. There is no statistical difference in the degree of awareness among male and female chemistry teachers on the use of AI tools in teaching
2. There is no significant difference in degree of male and female chemistry teachers' accessibility to the application of AI tools in teaching.
3. There is no statistical significant difference on the extent to which male and female chemistry teachers utilize AI resources in their instructional strategies

Methodology

The study employed a descriptive survey as its research design. The population was made of 166 chemistry teachers from public secondary schools in Abeokuta Metropolis. Purposive sample of 64 chemistry teachers consisting of (30 males and 34 females) were used for in the research. Teachers' aware of, access to, and use of AI tools for teaching chemistry (TAAUATLC) adapted from Enebechi et al. (2024) and Zudonu et al. (2024) was an instrument employed to gather data. There are two parts to the instrument. Section A includes the identification number and gender of the teachers. Section B comprises three clusters of teachers' awareness, accessibility and utilization of artificial intelligence for teaching chemistry (TAAUAITC). A four-point modified Likert scale was used to arrange the 30 questions in each of the three clusters, which included ten (10) item statements: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The ratings for the responses were SA = 4, A = 3, D = 2, and SD = 1. Three professionals in the domains of measurement and

evaluation, computer science, and chemistry education face validated the tool. Using Cronbach Alpha, the TAAUAITC's internal consistency reliability index was determined to be 0.84. The teachers' awareness, accessibility and utilization of artificial intelligence for teaching chemistry was administered to the teachers by the researchers. The study questions were answered using the mean, standard deviation, and t-test at the 0.05 level of

significance was used to assess the hypotheses. Decisions were made using a benchmark mean score, where a score of 2.50 or more was regarded as high, whereas one that was less than 2.50 was regarded as low for research questions and if the computed p-value was greater than 0.05, the hypothesis was accepted; if it was less than 0.05, it was rejected.

Results

Table 1: Mean and standard deviation of the degree of awareness among chemistry teachers on the use of AI tools in teaching.

S/N	Statement	N	\bar{X}	SD	
1	I am aware of Virtual laboratory	64	2.35	1.10	
2	I am aware of Adaptive learning Platform	64	2.18	0.84	
3	I am aware of Education Apps	64	2.40	0.92	
4	I am aware of Intelligent tutoring systems	64	2.31	0.94	
5	I am aware of Data analysis and visualization tools	64	2.50	1.31	
6	I am aware of Natural language processing (NLP) tools	64	2.36	1.12	
7	I am aware of Virtual reality (VR)	64	2.52	0.84	
8	I am aware of Augmented reality (AR)	64	2.23	1.14	
9	I am aware of Concept mapping tools	64	2.18	1.10	
10	I am aware of Machine learning Algorithm	64	2.44	0.88	
Overall Mean and Standard Deviation			64	2.11	0.91

Results in Table 1 reveals an overall mean of 2.11 and SD of 0.91. The mean of 2.11 is less than 2.50 set as a benchmark, hence, the extent to

which Chemistry teachers are aware of AI tools applied in instruction is low.

Table 2: t-test mean difference in the degree of awareness among male and female chemistry teachers on the use of AI tools in teaching.

Gender Decision	N	\bar{x}	SD	Df	t-cal.	T-crit.	P-val.	Alpha val.
Male	30	2.12	1.02	62	1.62	1.96	0.06	0.05
Female	34	2.10	0.80					

Table 2 revealed that the female teachers' mean and standard deviation scores were 2.10 and 0.80, respectively, whereas the male teachers' were 2.12 and 1.03. Since the p-value of 0.06 is more than the alpha threshold of 0.05, the calculated t-value of 1.62 with 62 degrees of freedom was determined to

be not statistically. Consequently, the first null hypothesis is retained. This suggests that there is not a discernible difference between the degree of male and female chemistry teachers' awareness of AI tools used in teaching.

Table 3: Mean and standard deviation of degree of Chemistry teachers' accessibility to the application of AI tools in teaching.

S/N	Statement	N	\bar{X}	SD
11	I can access Virtual laboratory	64	1.88	0.94
12	I can access Adaptive learning Platform	64	1.95	1.04
13	I can access Education Apps	64	2.30	1.12
14	I can access Intelligent tutoring systems	64	2.13	0.91

15	I can access Data analysis and visualization tools	64	1.98	0.93	
16	I can access Natural language processing (NLP) tools	64	2.35	1.05	
17	I can access Virtual reality (VR)	64	1.80	1.13	
18	I can access Augmented reality (AR)	64	1.86	1.11	
19	I can access Concept mapping tools	64	1.84	0.92	
20	I can access Machine learning Algorithm	64	2.03	0.98	
Overall Mean and Standard Deviation			64	2.01	1.01

The results in Table 3 shows an overall mean of 2.01 and SD of 1.01. The mean of 2.01 is less than 2.50 set as a benchmark, hence, the level of

Chemistry teachers' accessibility of AI tools used in teaching is low.

Table 4: t-test mean difference in degree of male and female chemistry teachers' accessibility to the application of AI tools in teaching.

Gender	N	\bar{x}	SD	Df	t-cal.	T-crit.	P-val.	Alpha val.
Male	30	1.96	1.06	62	1.65	1.96	0.08	0.05
Female	34	2.06	0.96					Not Significant

Table 4 shows that male instructors' mean score was 1.96 with a standard deviation of 1.06. In contrast, female teachers' mean score was 2.06 with a 0.96 standard deviation. Given that the p-value of 0.08 exceeds the 0.05 alpha threshold, the calculated t-value of 1.65 with 62 degrees of

freedom was not statistically significant. Therefore, the null hypothesis is accepted, indicating that there is no appreciable difference in the accessibility of AI teaching tools between male and female chemistry teachers.

Table 5: Mean and standard deviation of the extent to which Chemistry teachers utilize AI tools in their teaching practices.

S/N	Statement	N	\bar{X}	SD	
21	I use Virtual laboratory in teaching	64	2.42	1.00	
22	I use Adaptive learning Platform	64	2.28	1.12	
23	I use Education Apps	64	2.14	1.01	
24	I use intelligent tutoring systems	64	2.30	1.02	
25	I use data analysis and visualization tools	64	2.10	0.96	
26	I use Natural language processing (NLP) tools	64	1.88	0.94	
27	I use Virtual reality (VR)	64	2.13	0.98	
28	I use Augmented reality (AR)	64	1.94	0.96	
29	I use Concept mapping tools	64	2.04	0.98	
30.	I use Machine learning Algorithm	64	2.12	0.98	
Overall Mean and Standard Deviation			64	2.14	1.00

The results in Table 5 indicates an overall mean of 2.14 and SD of 1.00. The mean of 2.14 is less than

2.50 set as a benchmark, therefore, there is little use of AI tools by chemistry teachers in their instruction.

Table 6: t-test mean difference on the extent to which male and female chemistry teachers utilize AI resources in their instructional strategies

Gender	N	\bar{x}	SD	Df	t-cal.	T-crit.	P-val.	Alpha val.
Male	30	2.10	1.04	62	1.73	1.96	0.07	0.05
Female	34	2.18	0.96					

Table 6 shows that male instructors' mean score was 2.10 with a standard deviation of 1.04. In contrast, female teachers had an average score of 2.18 with a standard deviation of 0.96. Given that the p-value of 0.07 above the 0.05 alpha level, the computed t-value of 1.73 with 62 degrees of freedom was determined to be not statistically significant. Consequently, the null hypothesis is supported, indicating that there is no appreciable distinction between the application of AI technologies in the classroom by male and female chemistry teachers.

Discussion

Chemistry teachers in Abeokuta Metropolis, Ogun State, demonstrated a poor degree of awareness in relation to the application of AI technology in education, as per the examination of first research question and hypothesis. Additionally, there was no appreciable difference in the awareness of AI between male and female chemistry teachers. This implies that the majority of educators are not aware of the possible applications of artificial intelligence in the classroom, and that gender has no bearing on this ignorance. This finding aligns with the study conducted by Alimi et al. (2021), which found a low level of awareness and no significant gender-based difference in university students' knowledge of AI usage for learning. This is in line with the results of Adebayo (2023), who said that although the government of Nigeria is working to integrate ICT into education, it is unclear how widely AI is being used in secondary schools, mostly in Ogun State. However, finding was not in accordance with the finding of Owolabi et al., (2022) who found that Nigeria Polytechnic students were aware during library orientation programs that AI was implemented in library services.

Regarding the access of AI technology in the classroom, according to the analysis of AI technologies for teaching chemistry was low among teachers and no meaningful variation between male and female chemistry teachers' access to Artificial intelligence tools used in teaching. The results are consistent with those of Alimi et al. (2021), who found that the difference between males and females is not statistically significant according to their

accessibility to AI for learning purposes among university students. The results are consistent with those of Zudonu et al. (2024), who found that chemistry teachers in River State had a low and non-significant difference in their perceptions of the availability of AI resources and technology.

The examination of the third research question and hypothesis revealed that there was little evidence of chemistry teachers' utilization of artificial intelligence (AI) teaching tools, and the differences between male and female chemistry teachers are negligible in their usage of these tools. This outcome is consistent with research by Enebechi et al. (2024), which found that Enugu State secondary school students, both male and female demonstrated low and statistically similar levels of AI tool usage for learning biology. The results are consistent with those of Zudonu et al. (2024), who found that chemistry teachers in River State had a low and non-significant difference in their perceptions of the usefulness of AI resources and technology. However, the finding was in disagreement with the finding of Faruku (2024), who found that teachers' employment of AI technologies in secondary schools in Sokoto State, the use of AI technologies for chemistry instruction and learning was not lacking.

Conclusion

Based on the study's results and discussions, the researchers came to the conclusion that, while there are many obstacles, integrating AI in secondary education Chemistry instruction in Abeokuta Metropolis, Ogun State, has showed encouraging promise. The results showed that awareness, accessibility, and use of AI tools for teaching chemistry were low among male and female chemistry teachers and did not differ significantly. This is in line with studies conducted in other domains where access, awareness, and application of AI are relatively poor, especially in locations with inadequate sensitization, infrastructure, and opportunities for skill development. The study's findings also suggest that gender has no bearing on chemistry teachers' knowledge of, access to, or use of AI tools in the classroom.

Recommendations

The study's conclusions led to the following recommendations being made:

1. The government ought to offer in-service training and on the job, artificial intelligence training for the chemistry teachers for increased teachers' awareness, accessibility and utilization of artificial intelligence (AI) in chemistry instruction
2. Schools within Abeokuta Metropolis are encouraged to invest in essential infrastructure such as stable internet connectivity, computer laboratories, and appropriate software to facilitate the effective adoption of AI tools.
3. Motivating educators to include AI into their curriculum and lesson plans
4. Sensitization on the advantages and difficulties of AI in education involving students, parents, and the general public.

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